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ECONOMIC GEOGRAPHY

APRIL

CLARK UNIVERSITY, WORCESTER, MASSACHUSETTS, U.S.A.

OUR CONTRIBUTORS

Dr. Jones, associate professor of economic geography at Clark University, contributes "Chilean Commerce," the fifth article in a trade series on commerce of South American Republics, to be followed by other similar studies. With Mr. Rosenfeld of the Tropical Plant Research Foundation Dr. Jones will contribute "The Cotton Industry of Peru," a study based on field work in the irrigated cotton valleys.

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THE COMMERCIAL GEOGRAPHER

IF American relationships with other countries of the earth are to attain economic and political permanence, the geographer, versed in the lore of trade and transportation, as well as in the physical conditions affecting them, and in the attributes of foreign peoples, will play an important part in foreign trade and commerce. To avoid mistakes that may adversely affect friendly intercourse between the nations, importers as well as exporters, international banking concerns as well as transportation companies, and the diplomatic service as well as manufacturers, will engage the expert geographer to help them plan and execute their programs.

In no field of American foreign trade is there the possibility of such far-reaching and momentous results as in the trade with Central and South America. It would be a rash guess to predict what the final outcome of the growing commerce, the closer and friendlier trade connection between the republics of South and Central America, and the United States will be. Certainly the prospect of a Pan-American rapprochement that shall be more beneficial to all concerned with each passing year as it has been for the past decade, grows continually brighter. It augurs well for the future that, in spite of occasional tension and strained situations, the peoples of the two American continents understand each other better, and solve their differences of opinion and policy with less friction, than ever before.

It is to the promotion of such close and effective association in trade and commerce that the commercial geographer can devote his energies most advantageously. Freed from the restrictions and routine of classroom duties, his vision broadened by foreign travel, his provincial academic education enriched by contact with foreign peoples, his field of activity enlarged by international correspondence and experience, he becomes invaluable to the business and commercial interests that have chosen the wide world for their sphere of action. To develop friendly relationships, to promote international good will, to safeguard the standing of American industry and trade in every foreign land—these the trained commercial geographer can be chosen to do.

Already the few American geographers who have had an opportunity to demonstrate the value of their training have rendered invaluable service. Eight or ten men and one or two women have pointed the way in the applied commercial field, and proved their worth. In another decade or two the names will be legion.

ECONOMIC GEOGRAPHY

VOL. III APRIL, 1927 No. 2

CHILEAN COMMERCE

Clarence F. Jones

Economic Geographer, Clark University

CHILE, the smallest of the A–B–C Republics, holds third place in the commerce of South America, with 10 per cent of the trade of the continent. The value of its commerce amounts to more than one-half that of Brazil, whose vast extent embraces 45 per cent of the area of South America, and about one-fifth that of Argentina, the premier commercial republic of the southern hemisphere. While it does not constitute an imperial domain like Brazil, its per capita trade is three and one-half times that of the great Republic. In 1925, the per capita trade of Brazil was 28 dollars, of Chile 100 dollars, and of Argentine 200 dollars.

Great length and contrasted relief give Chile a variety of regional environments and resources. In area, it equals California, Oregon, and one-half of Washington; but its length equals the distance from southern Alaska to southern Mexico; no part of the country is more than 250 miles from the sea. In the north, the barren and parched desert holds the dominating nitrate riches of the country; in the central section, the agricultural and pastoral lands of Mediterranean Chile support fully three-fourths of the people of the republic and afford a fertile commercial field; in the south, forested island, rugged headlands, and stormy seas reign supreme; and to the east of all these sections tower the pinnacled Andes, in whose isolated recesses lies the nation's wealth of copper.

In spite of the proximity of all parts of the country to the sea, it lacks adequate transportation facilities, the key to modern commercial progress. It constitutes one of the more remote sections of South America; to the east, the formidable Andean barrier effectively separates Chile from its neighbors; Valparaiso, the chief port of the nation, is 4,600 miles from New York by way of the Panama Canal, and 20 days by the fastest ships on this route. While sixty or more ports have developed along the Chilean littoral almost all of them are exposed to the ocean swell and to the "northers" which sweep the coast; there are no safe anchorages or harbors. In the absence of artificial breakwaters, ships anchor from one-quarter of a mile to a mile and a half off shore and transfer freight and passengers by barges and launches, a slow and inefficient means of transfer (Fig. 1). Since no one large trade center, with facilities for distributing goods to a considerable part of the country, exists, it is not economically feasible for Chile to supply many of the ports with modern equipment. Furthermore, Chile has only 5,640 miles of railway; one-half of this mileage is in the longitudinal railway, which extends from Tacna in the north to Puerto Montt in the south and lies parallel to the coast. Consequently, it carries little freight; it is connected with points on the sea by short spurs at more than thirty different places. No railway net exists; short transverse lines connect mineral sections or agricultural districts with ocean ports.

FIGURE 1.—Unloading automobiles at San Antonio, Chile. As the steamship rolls from side to side owing to the large ocean swell at most Chilean ports, slingloads frequently are battered against the steel ship, breaking the boxes and damaging greatly the contents, or opening the way for pilferers so active in most ports of South America.

As in Peru and Bolivia, the mestizo does not form a prominent figure in the trade of the country except as he labors in the nitrate fields and copper camps, engages in transportation, or enters commercial activities in central Chile. Seventy-four per cent of the population of the country consists of mestizos; fully one-half of the total is the agricultural *roto*, who has the use of a patch of land, a wretched adobe hut, a small wage, and feudal obligations to serve the wealthy landowner. He works hard, lives miserably, and, consequently, does not enter significantly the commercial life of the country. On the other hand, the rather large wealthy class—proprietors of landed estates, capitalists, both foreign and Chilean—and a small middle class supply the chief export commodities and afford a field for the variety of goods the import trade offers.

THE GROWTH OF TRADE

In contrast to other parts of South America, Chile had no brilliant colonial commercial history. By Spain's policy, the country was hindered in its attempts to develop commerce, since the mineral wealth had not been developed. Throughout colonial times, Chile exported small quantities of wheat, wine, woolen ponchos, honey, hams, lard, and beef—commodities produced in the home country. Small amounts of copper for use in the manufacture of munitions for defense against pirates and corsairs were exported. Those conditions prevailed until the proclamation of independence in 1810.

During the first half century of independence, copper and silver exports increased gradually, replacing wheat as the leading commodity; yet wheat enjoyed an active demand in Peru with the working of the guano deposits, in California for the gold miners and prospectors, and in England after the repeal of the corn laws. In the seventies, a marked drop of silver resulted from the Franco-Prussian War and the adoption of a gold standard by Germany.

In the late seventies, the guano and nitrate deposits near the northern boundary of Chile were opened, but the exportation of nitrates did not assume importance until 1880, when the Peruvian and Bolivian territory containing the chief nitrates resources passed Chilean control. In 1877, two years before the War of the Pacific began, the trade of Peru reached a figure which it did not equal for a quarter of a century. In contrast, the exports of nitrate from Chile in 1880 amounted to 30 per cent of the total exports; in five years they doubled in value and increased to 60 per cent of the total exports.

Under the stimulus of nitrate development and the prosperity it brought, the commerce of the Republic increased gradually to 52 million dollars in 1896. The last thirty years comprise two distinct periods, a substantial and steady growth from 1896 to 1914, and

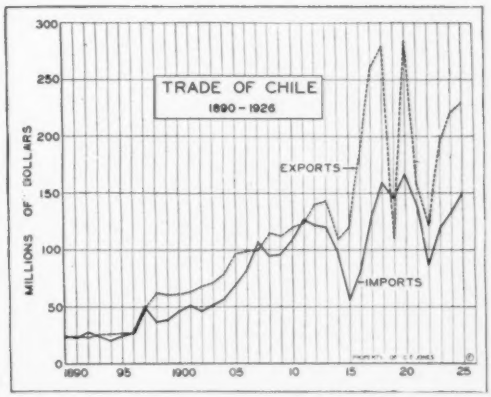

FIGURE 2.—The Trade of Chile increased from 50 million dollars in 1890 to 377 million in 1925. In spite of the great fluctuation during the last twelve years, the general rate of increase has been maintained.

a period of violent fluctuations from the outbreak of the World War to the present (Fig. 2).

During the former period, the gradual rise in most of the export commodities gave the country commercial stability. The years 1910–1912 were among the most prosperous the country experienced. As a result, many merchants overstocked with goods, speculation was rife and values were inflated. Even before the war broke out, financial conditions indicated that the era of prosperity had reached its highest point.

When the War came, Chile, like other South American countries, faced tremendous difficulties; business was completely paralyzed. The falling off in nitrate exports and the uncertainty concerning the prospects of moving the accumulated stocks created a crisis. Though all work in the nitrate fields was stopped, and 50,000 workmen thrown out of employment, this condition was only temporary.

The unprecedented demand for nitrates and copper created by the war, the high prices prevailing for these commodities, and the opening of the Panama Canal, which rearranged the trade routes of Chile, reëstablished trade conditions on a normal basis and more than doubled the trade of the country in three years. When the exports rose to the high figure of 278 million dollars in 1918, the world marts were flooded with nitrates. Owing to an oversupply, the cutting off of the demand for nitrates for munitions by the close of the war, and the decrease in the needs for copper, the exports of the country declined to the low mark of 1914; but they rose again under the influence of the short post-war boom and the period of inflation, to 284 million dollars in 1920, the high water mark in Chilean trade. The hard times following this period of prosperity and enhanced production are well known. The most significant facts expressed by the developments of the last three years demonstrate that the trend of growth established in the decade preceding the war has been maintained in spite of prosperous advances and exasperating reverses consequent upon the war and its effects, and that the favorable difference between exports and imports continues to increase.

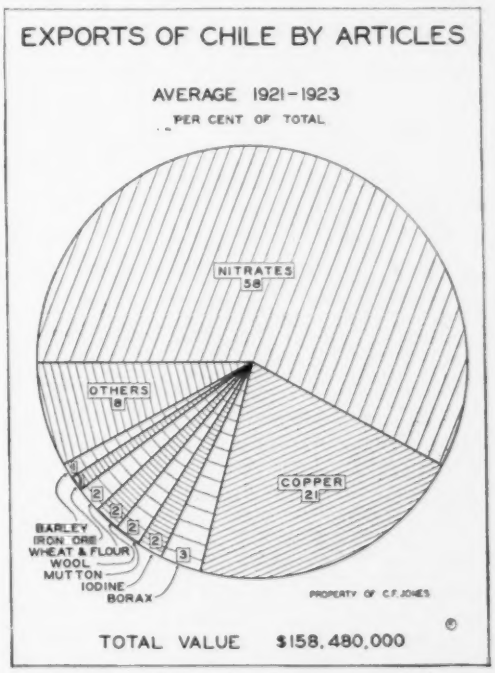

FIGURE 3.—More than 90 per cent of the exports of Chile consist of raw or partially manufactured industrial materials; they are largely products of the mineral industries; two commodities make up four-fifths of the total.

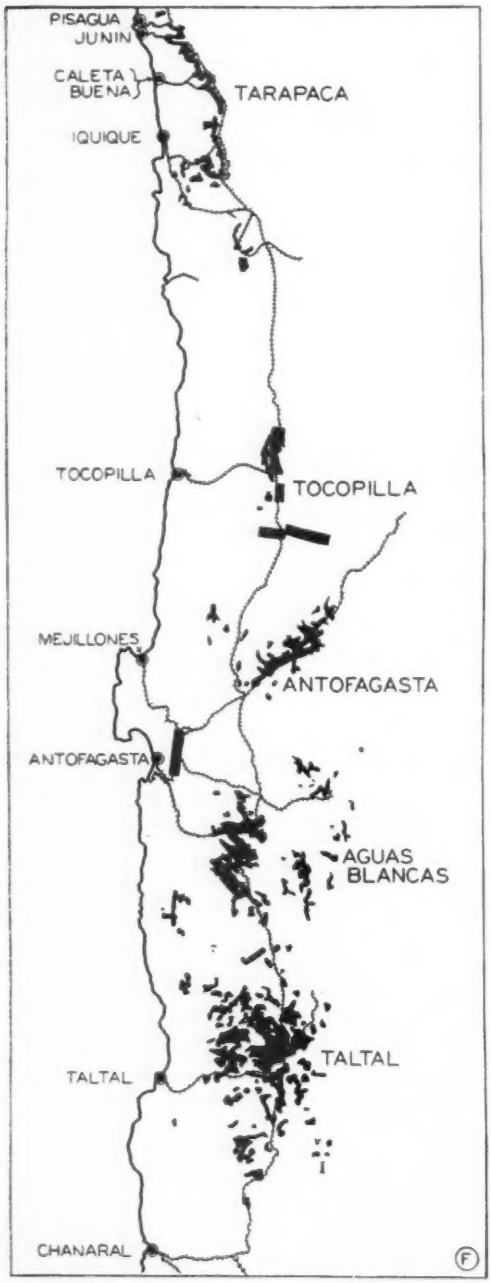

FIGURE 4.—The nitrate zone extends from 19° south latitude near the port of Pisagua to 26° south, a short distance beyond Taltal. In this stretch are five major nitrate producing districts each of which is served by one or more near-by ports. The deposits lie in the lower parts of the pampas, between the foothills of the coast ranges to the west and the lower slopes of the Andes to the east. Within the limits of a particular deposit there is marked variation in extent, thickness, depth, and grade.

THE EXPORT TRADE

Chile, like Argentina and Brazil, exports raw industrial materials and foodstuffs, but in contrast to them, the commodities come almost entirely from the mineral industries, whereas in the two leading commercial republics of South America, they are derived from the farms and the ranges. In value almost 90 per cent of the total exports are mineral products, as is inevitable in a country rich in mineral resources and lacking great expanses of arable land; parched deserts, rugged highlands, and drenched islands and headlands occupy most of the country. In spite of the varied agricultural resources, minerals dominate the nation commercially; they furnish most of the national revenue and supply much of the capital used for the purchase of imports. The output of nitrate alone and the money received from its sale serve as a delicate barometer on which to judge the nation's prosperity.

NITRATES

Although Chile possesses several elements of economic and commercial strength, the fact is obscured by the position of nitrate, which normally furnishes about 60 per cent of the total exports of the country (Fig. 3). What coffee is to Brazil, nitrate is to Chile; it serves as an effective index of trade, for commercial and industrial activities of the nation reflect closely the advances and reverses in the nitrate business. A decrease in activity in the nitrate region, owing to a slackening of the demand for nitrates in foreign markets, causes a drop in the total imports, an exodus of thousands of workers from the nitrate sections, a curtailed production of Chilean manufacturing plants sending supplies to the northern desert, a drop in the shipments of foodstuffs from agricultural Chile, and a feverish activity on the part of the Nitrate Producers' Association which attempts to regulate production, prices, shipments, and sales. On the other hand, a great demand for nitrate

brings plenty and prosperity to all parts of the country.

For almost a half century, the export tax on nitrate has supplied more than half the national revenue; some years the income from this source amounted to two-thirds of the total. During this time, it afforded the capital with which the government was financed and most of the major improvements accomplished. It has been so vital to the financial policy of Chile that without a fair degree of activity in nitrate shipments, the treasury would quickly be embarrassed.

During this period, Chilean nitrate has become one of the world's leading commercial products. The industry has

The Growth of the Industry

Beginning with 1880, the year the holdings of Peru and Bolivia passed to Chilean control, the production of nitrate increased from a quarter million metric tons to 2,785,000 tons in 1913 (Fig. 5). The end of this period, marked by over-buying, speculation, over-production, and inflated values, was followed by tremendous difficulties.

When the war came, the falling off in nitrate exports and uncertainty of delivering the accumulated stocks produced a crisis. Practically all work in the nitrate fields ceased; hundreds of laborers migrated to the coast, where they slept on docks, awaiting free passage to farms

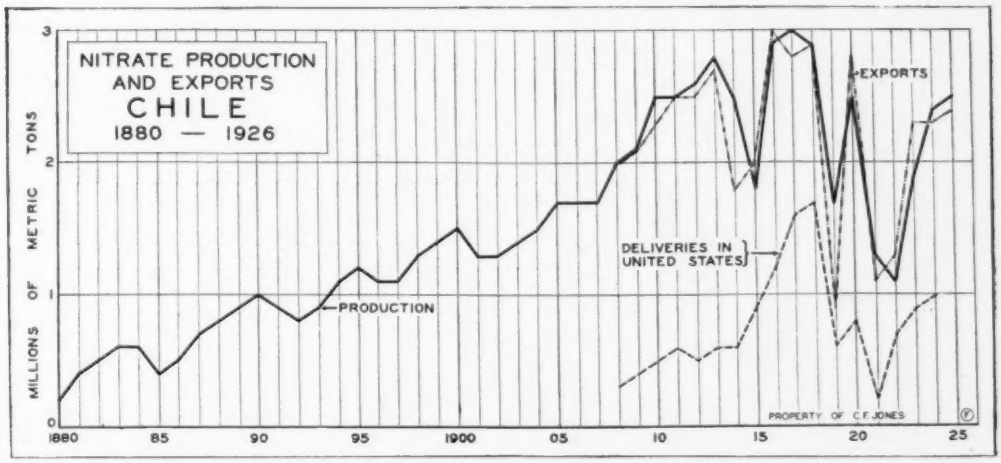

FIGURE 5.—During the last forty-five years, Chile has practically dominated the nitrate market, for the country holds in the desert of the north, the only large deposits of nitrate in the world. To the production and marketing of this commodity, the country largely owes its commercial importance. Nitrate is almost entirely an export product as very little is used in Chile.

satisfied increasing demands upon it for maintaining the fertility of the impoverished soils of Europe and southeastern United States and has been applied to many industrial operations and manufacturing processes; with the evolution of military explosives it became an essential item in war. In the Chilean desert exists the only large natural nitrate deposits of the world and with only a small production of artificial nitrate, the desert commodity has dominated the world's markets and prices (Fig. 4).

of central Chile or to irrigated valleys of Peru. The total number of unemployed in the north reached 50,000, about one-third of whom were heads of families. Never before had reverses in the nitrate business caused such an exodus. There were no quotations for exchange in Europe for more than 90 days and when they were resumed in October, 1914, the value of the Chilean peso had fallen from 19 cents (average for 1913) to 14½ cents. The Chilean Government declared a moratorium of thirty days on all ob-

ligations contracted before August 1914; this moratorium was extended from time to time until the latter part of 1915.

The years following this first crisis witnessed marked advances and disastrous reverses. The great demand for nitrates as war materials, and as fertilizers to increase food production for the armies, brought the exports to almost three million metric tons in 1916. This high level of exports was maintained for two years; then the greatest period of prosperity the nitrate industry had experienced was cut short by the close of the war, which eliminated the demand for explosives. Exports dropped in one year from 2,900,000 tons to 900,000 tons, only to rise again in the same length of time to 2,700,000 tons.

The post-war depression in the industry grew out of (1) decreased demands for nitrates, (2) lack of a free competitive market, resulting from the centralization of sales in the Producers' Association which raised the price to abnormal figures in 1920 and 1921, thereby discouraging the use of nitrates and giving impetus to the demand for substitutes, (3) world-wide business depression following 1920, making it difficult to finance purchases of nitrate in Europe and reacting upon consumers elsewhere, and (4) restriction of imports of Chilean nitrates by Germany, the largest consumer before the war, in order to increase the output of the synthetic product at home.

Despite the great fluctuations in the industry during the decade, 1914–1924, will the industry return to normal? Statistics of 1924 and 1925 indicate that production *may have* reached then the general trend of increase followed from 1880 to 1907 (Fig. 5). That this trend of growth will be maintained for some time is doubtful, yet a continued expansion of the industry is so vital to all Chile, that the future of the nitrate region is a question of large import.

The Life of the Nitrate Industry

Various estimates have designated the life of the nitrate industry from 35 years to more than 200 years. The smaller estimates of pessimistic prophets indicate a speedy exhaustion of the nitrate supplies and the financial collapse of Chile, without adequate preparation for readjustment. They make little or no allowance for discoveries of new deposits, which is probable, nor do they take into account improvements in processes of manufacture which may make possible a price reduction and the working of lower and lower grades of material. They fail to take into account the possible influence of artificial nitrate on lengthening the life of the reserves.

On the other hand, more optimistic prophets estimate that a long era of great prosperity lies ahead of Chile in the exploitation of the huge nitrate reserves of this otherwise barren region. They have made exaggerated statements based on meager data as to possible reserves. In 1923, the Chilean inspector-general of nitrate deposits classified 80,000 square miles (*27 per cent of the total area of the country*) as nitrate-bearing ground, of which 2,320 square miles had been examined by excavations and test holes. The examined area was calculated to contain 245,300,000 metric tons of sodium nitrate—100 years' supply at the rate of production then existing. The non-examined area was estimated to contain 290,000,000 metric tons. No material containing less than 11 per cent of sodium nitrate was taken into consideration in the examined areas.

Within a particular deposit, marked variations in thickness, depth, grade, and extent make rather loose calculations of little value. Only 40 to 50 per cent of the land previously classified as nitrate ground by the Chilean officials and taken up for nitrate mining proves to be workable. As a matter of fact, no data exist for making an accurate inventory. No complete geological survey has been made; even the origin and association of *caliche* is still debated. Nevertheless, there seems to be no reason to anticipate any early shortage of raw

material; the supply is sufficient to meet the probable demand for a century.[1]

Trends in Production

With reserves for decades to come, the most vital problem is: how long can Chile produce and market nitrate in competition with the synthetic product? The world consumption of nitrogen during the last forty years has increased tremendously, but in 1894 Chilean nitrates supplied 73 per cent of the world's demand, whereas in 1913–1914 they furnished 53 per cent, and during 1925–1926 only 26 per cent. Chilean nitrate exports dropped from 2,565,000 metric tons for the nitrate year 1924–1925 to 2,247,000 in 1925–1926, while stocks increased one-half million tons; present trends indicate that this year's export total will fall below 2,000,000 tons; on the other hand, the world's production of synthetic nitrogen increased 20 per cent. Germany, formerly the largest consumer of Chilean nitrate, now supplies domestic needs from her own factories and is looking about for an export market. In the United States, at present, the chief market for the Chilean output, the consumption of artificial compounds of nitrogen increased almost 25 per cent and that of natural nitrate but little.

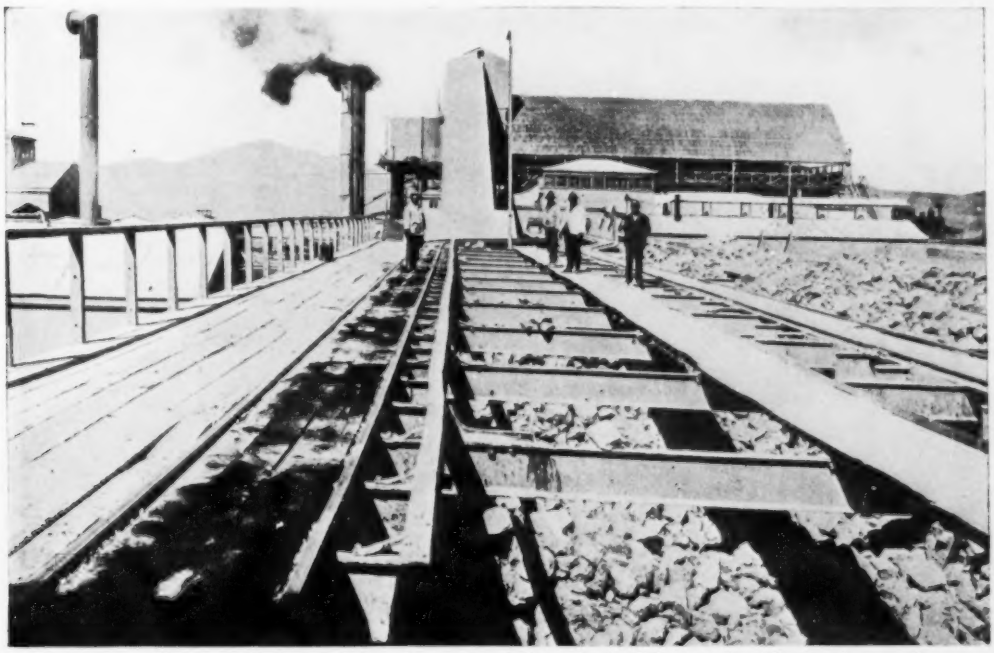

FIGURE 6.—The world's demand for nitrate has led to the building up in this desolate region considerable communities with water, electric lights, railway service, moving-picture shows, luxurious club houses, and all the features of civilized life. The cost of all these must be included in the price of the nitrate to the consumer. *Oficina* Aconcagua. (Courtesy Lautaro Nitrate Co.)

The policy of the Nitrate Producers' Association of fixing the price at the level at which the artificial products could be sold has acted as a stimulus to the latter industry. Chilean nitrate has lost the dominant position in the fertilizer trade it held for decades. Thus, it seems that the ability of the natural product to compete with artificial fertilizers depends upon the cost to the consumer.

The greatest obstacle facing a reduction of primary costs is the character of

[1] Boice and Mulliken, "Nitrogen Survey, Part I, the Cost of Chilean Nitrate." *Trade Information Bulletin* No. 170, Jan., 1924, p. 41 ff.; Whitehead, "The Chilean Nitrate Deposits," *Economic Geology*, Vol. XV, pp. 187–274, 1920; Statistics from Chilean Nitrate Engineers, Santiago, April, 1925, in conference.

the nitrate country. In this barren desert, everything utilized in the industry, except rock, sand, and gravel, must be brought in from long distances. For most *oficinas*, fresh water must be piped 100 miles or more from the Andes, and only in part of the region can salt water for the treating plants be obtained from wells at feasible depths. No vegetation clothes the nude desert stretches. Only one river crosses the pampa. Men, food supplies, animals, feed, structural steel and timbers, machinery, and fuel from diverse regions of the world enter only at considerable expense (Fig. 6).

A new process of extracting nitrate from *caliche*, now being put into operation by Guggenheim Brothers, increases the amount of nitrate recovered from raw material from 60 per cent to almost 90 per cent; it calls for large-scale operations in 7,000 ton vats, at a centralized plant, thus reducing overhead costs by 25 per cent; it will reduce fuel requirements considerably. The total possible reduction of price by improvements in processes, centralization of plants, and reduction of profits may amount to about twelve dollars per ton. Against this decrease must be placed a possible increase of $7.50 per ton owing to higher insurance rates and the recovery of exchange, thus leaving only a small margin for reduction in price from the primary costs.

The largest item in the cost which may be changed materially lies in the government export tax of about ten dollars per ton. With severe competition from synthetic nitrogen during recent months, concerted effort has been made by producers to persuade the Chilean government to reduce the export duty, the Producers' Association offering to make an equal price reduction. In spite of repeated requests, the Chilean minister of finance has remained firm as to the duty for the fiscal year 1926–1927, and the prices fixed by the Association have been reduced only 1 shilling per quintal from the price of the previous year. In the meantime, the visible stocks of nitrate increased to 1,834,000 tons by the end of December, 1926, and out of 91 plants in operation in January, 1926, 61 had closed down by December 31.

As the reduction of the export tax constitutes the chief step toward the reduction of the price of nitrate, the industry at this critical time rests largely in the hands of the officials of the Chilean Government. It is true that this tax has been vital to the Republic; from the proceeds of the nitrate tax, Chile has built ports, railways, and permanent

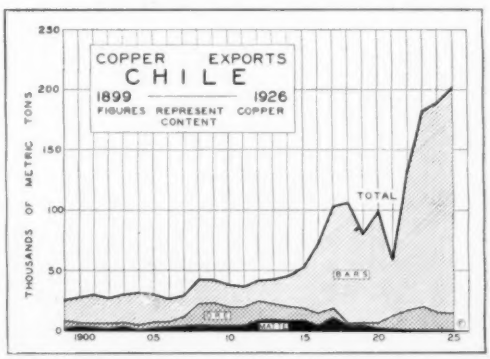

FIGURE 7.—The rapid rise in the copper exports of Chile during the last twelve years resulted chiefly from the large scale developments of low-grade deposits at Chuquicamata and Teniente.

improvements which have considerable potential earning capacity; the tax has contributed materially to the operating expenses of the government, while sources of revenue regularly depended upon by other governments remained untapped. The nitrate industry faces tremendous difficulties in the competition from the synthetic product; the producers unable to move accumulated stocks reluctantly close down their plants. In the face of this crisis will the officials of the Chilean Government rise to the occasion and reduce, or if necessary remove entirely, the nitrate export tax and reset in motion the wheels of industry in the northern desert, with its huge fixed investment in plants, railways, ports, and cities dependent on nitrate? Or will they stand firm on the tax, as they have in the past, and seriously impair forever the oviducts of the Chilean golden goose?

COPPER

Since the production of copper in Chile has not the monopolistic character held by the nitrate trade, the copper industry does not yield the public treasury a direct income, except for the taxes paid by the mining companies; but the employment afforded by the mines and the transportation incident to the business supports large numbers of people and contributes to the general welfare of the country. Copper amounts to 21 per cent of the value of the export trade and accounts, through the materials required in the industry, for a considerable part of the imports (Fig. 3).

Copper has been mined in Chile for centuries by Indians and Spaniards. The latter worked high-grade carbonate and oxide deposits near the surface and smelted the ore in charcoal furnaces. However, the production did not assume importance until after 1842, when the first reverberatory furnace was built at Coquimbo Then the output gradually increased; Chile became the leading copper-producing country of the world, supplying from 60 to 70 per cent of the total. In 1876, Chile produced 46,400 tons of copper. In those days the copper districts at Copiapo and Coquimbo were the most progressive sections of the country. Exhaustion of the richer veins of the coastal zone, scarcity of labor on account of the expansion of the nitrate business, lack of transportation facilities, and competition from United States copper caused a decline in the Chilean industry, the production falling to almost 25,000 tons a year, which was maintained for a quarter of a century.

About 1900, the industry began to revive slowly, but not until 1915 did the output surpass the figure of forty years previous (Fig. 7). Then the production more than doubled in two years under the influence of bounding increase in price, augmented war demands, and marked technical improvements in the industry, facilitating the utilization of low-grade deposits. The close of the war, cutting off war demands, and the period of world depression in 1921 caused a temporary setback in the industry. The production rose to almost 190,000 metric tons in 1926. Thus copper, like nitrate, has played a significant part in the phenomenal growth of Chilean trade.

FIGURE 8.—Seven of the eleven levels on Chuquicamata Hill, the most extensive copper deposit of the world. The known and probable ore reserves averaging 2.12 per cent copper total 688,000,000 tons.

Producing Districts

In the past, the importance of the country as a copper producer depended

upon numerous small vein mines of high-grade ore, widely distributed through the coastal ranges. In contrast, at present, almost 90 per cent of the output of the Republic comes from two huge low-grade deposits high up on the western slope of the Andes. Immense development work and large scale operations backed by millions of dollars account for the rapid rise during the last fifteen years in the electrolytic product of the Chile Copper Company at Chuquicamata, and

FIGURE 9.—General view of the copper plant at Sewell. The world's demand for copper takes men, money, and large quantities of all kinds of equipment into the more isolated recesses of the Andes. (Courtesy Braden Copper Co.)

in the blister copper of the Braden Copper Company near Rancagua.

At Chuquicamata, about fourteen miles north of Calama and five and one-half miles from the Antofagasta-Bolivia railway, lie the most extensive copper deposits of the world. Most of Chuquicamata hill, which covers an area of two and one-half miles by one-third of a mile, consists of shattered rock so thoroughly mineralized that the entire mass of rock is considered ore.

The entire hill is blasted with huge charges of explosives and the material loaded with steam shovels into railway cars on eleven different levels (Fig. 8). The ore moves down grade in these cars to powerful and dinning crushers which prepare it for treatment.

The unique treatment of the ore at Chuquicamata makes for cheap production. The easily soluble *oxide* minerals, which are a result of the extreme aridity of the region, after being crushed are sent to immense concrete tanks, where the copper is leached out with sulphuric acid. After the cupric chloride is changed to insoluble cuprous chloride, by passing the solutions through revolving cylinders containing granulated copper, then separated by filtering, the remaining copper precipitated by electrolysis is melted and molded into bars for shipment.

The huge-scale bench blasting and steam shovel mining and the simple method of recovering the copper allow cheap production on a scale not equalled anywhere else in the world and give a high-grade copper, which stands at a premium for making copper wire; fully three-fifths of the output go into this use.

The capacity of the present plant is 125,000 tons of copper per annum. The developments at Chuquicamata during the past fourteen years represent a remarkable achievement in the face of the major handicaps. Fuel and structural materials come from distant fields and factories, labor from central Chile and other regions, and food from diverse places including beef on the hoof from the plains of eastern Bolivia two hundred miles away, while fresh water is brought about 70 miles in pipes from the high Andes and salt water for the leaching plants from points 40 miles distant. The mines lie in a very rugged part of the main range of the Andes at an elevation of about 8,000 feet and 43 miles from the longitudinal railway at Rancagua, with which they are connected by a narrow-gauge line. The excessive snowfall in winter frequently causes disastrous snow slides; the ore is hauled about a mile to the concentrating mill by locomotives over a snow-shed covered track practically the entire distance.

The Future of Copper in Chilean Trade

Recent developments at the preceding places have shown the possibility of working low-grade deposits with profit in the face of tremendous handicaps. Neither inaccessibility of high altitudes in precipitous mountain gorges nor the desiccation of the desert has prevented huge investments and large-scale operations.

FIGURE 10.—Potrerillos, Chile, the newest large scale copper development in South America, calls on outside regions for everything utilized in the industry. The plant has a capacity of 90,000 tons of copper per year.

The other district, which has aided materially in increasing the importance of copper in Chilean trade, is that of the Teniente mines of the Braden Copper Company, located east of Rancagua. As at Chuquicamata, the remarkable development has taken place during the past 15 years, millions of dollars have been spent in plant equipment; the mill capacity is 10,000 tons of ore per day.

While operations there do not face the handicaps of the Chilean desert, they encounter other major difficulties (Fig. 9).

These probably will be followed by even greater developments of the enormous reserves. The known and possible reserves at Chuquicamata amount to 688,000,000 tons of ore averaging 2.12 per cent copper, a quantity sufficient to

last the company for a century at double the present rate of production. The completion of construction work begun in 1925 will increase the capacity of the plant to 187,500 tons of copper per year. The known reserves at Teniente amount to 150,000,000 tons averaging 2.42 per cent copper and the probable reserves about 100,000,000 tons averaging 1.88 per cent copper. In addition to these two huge deposits, 100,000,000 tons of ore averaging 1.4 per cent copper have been proved by the Andes Copper Company, at the Potrerillos mine in the Department of Chañaral. Almost forty million dollars have been spent in development work on the railroad from Pueblo Hundido and on 65 miles of water pipes, a 15,000 ton concentrator, a huge smelter, an electric plant, and a model town for 5,000 inhabitants (Fig. 10). The smelter has commenced limited operations and can produce 90,000 tons of copper per year when working at capacity. This new enterprise will increase materially the importance of copper in Chilean export trade. It is probable that other large deposits of this kind may be discovered.

The future of copper in Chile does not depend entirely upon the development of large deposits of low-grade ore. Hundreds of small vein mines, abandoned years ago, would pay handsome dividends if reopened and properly equipped. The building of new railway lines recently has increased the potential value of these old mines. While they may in time add materially to the copper export trade, the low-grade disseminated deposits undoubtedly will supply the major portion of the output and will continue for some time to place increasing quantities of high-grade copper on the world's markets.

BORAX

Borax constitutes 3 per cent of the total exports of Chile. Like nitrate, it is a desert product possessed in abundance. It is found in desiccated lakes known as *salares*. While Chile could furnish the entire world with all the borax needed for several centuries, the industry is not flourishing and cannot amount to much in the export trade. The output of borax in 1913 was 50,225 tons; in 1924 only 32,400. The drop resulted chiefly from the influence of the European War, the export tax of $3.50 per metric ton, and increased production and competition in the United States, the leading producer. The borax deposits of Chile are completely isolated from the rest of the country, and their exploitation has practically no effect on the nation as a whole. Consequently, they cannot figure in a large way in the export trade.

IODINE

Iodine, another product held by the desert in great quantities, supplies almost 2 per cent of the total export movement. It is a by-product in the refining of nitrate, being precipitated from the concentrated brines after the nitrate has been extracted. Although about two-thirds of the world's output comes from the nitrate region, the percentage decreases in the face of competition of other sources and the export duty. In spite of the fact that northern Chile holds large amounts of iodine, a marked rise in the exports is not to be expected, owing to the limited world demand. Its production in Chile is controlled by a central committee which assigns the quantity of iodine a nitrate plant may turn out during the year, the capacity of several of them being much more than this quota.

IRON ORE

Another mineral product of growing importance in the export trade is iron ore, which constitutes in value about 2 per cent of the total exports. After a number of attempts to develop an iron and steel industry based upon local ore and domestic sub-bituminous coal of Tertiary age mixed with imported coal, the plants closed down, and the chief deposit of high-grade iron ore at Tofo near La Serena was leased in 1913 by the Bethlehem-Chile Iron Mines Company,

a subsidiary of the Bethlehem Steel Corporation. The company now produces and ships one million tons of ore per year (1,113,000 in 1925). The completion of the Panama Canal made the deposits of Chile accessible to the steel industries of the United States.

The ore can be mined and shipped at a very low cost. It is extremely compact, free from impurities, and consists mainly of high-grade hematite. The ore body caps two hills. Only a thin and patchy loose soil, supporting a sparse vegetation of cactus and allied plants, constitutes the gangue between the ore boulders of the surface. It is practically free from the dikes of barren igneous rock in the terrane, so that everything quarried goes to the crusher whence it is shipped over an electric railway to the sea at Cruz Grande (Fig. 11).

Iron ore probably cannot play a leading rôle in the export trade of Chile in spite of extensive deposits of high-grade type, cheap production and shipment, and the lack of good coaking coal for the development of a domestic iron and steel industry. Yet it seems certain that the exports of this product will increase materially and that for some years to come Chile will hold first place among South American Republics as a producer of iron ore.

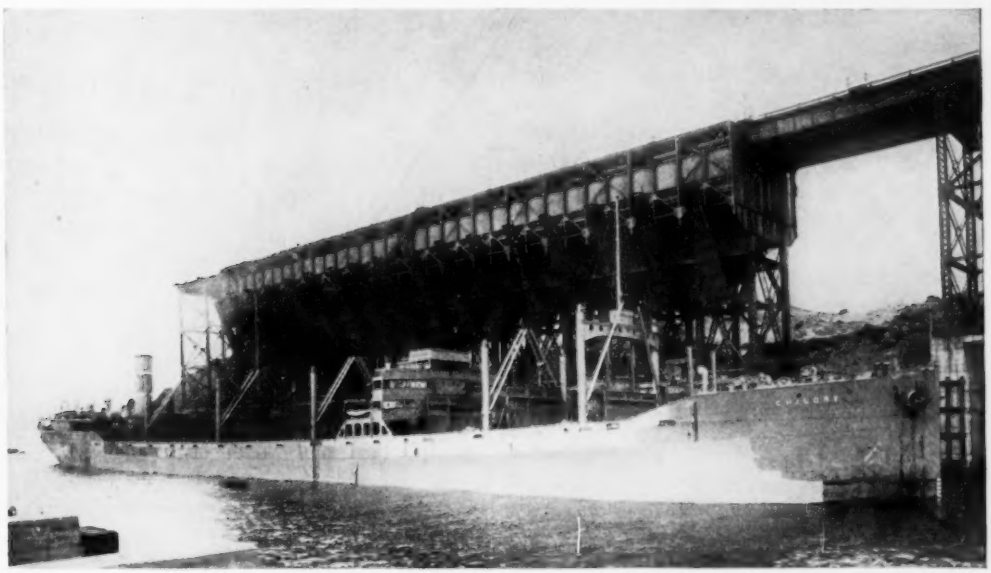

FIGURE 11.—Loading a 20,000 ton vessel with iron ore at the Basin Dock at Cruz Grande, Chile. Cruz Grande is connected with Tofo by an electric railroad 16 miles long. About 30,000 tons of ore are held in the Storage Dock for shipment as occasion requires. The straight line distance from the mine to dock is six miles. (Courtesy C. A. Buck, Vice-President, of the Bethlehem Steel Company.)

AGRICULTURAL EXPORTS

Before the production of nitrate became the main source of Chilean wealth, agricultural commodities shared the principal place with copper and silver. Now they constitute less than 8 per cent of the total exports. Yet the decrease is only relative as the chief agricultural exports have shown an absolute increase.

Mutton and Wool

Sheep products, mutton and wool, constitute the third export of Chile, amounting to 4 per cent of the total. While sheep are quite generally distributed throughout central Chile, practically all of the export mutton and nearly 80 per cent of that of wool come from the cool, windy and rainy plains bordering the shores of the eastern half of the Straits of Magellan.

In this region, a population of almost 30,000 depends chiefly upon the sheep industry. As a rule, because of the isolation of the region, pasture land is inexpensive and is held by large sheep-raising companies, owned by Chilean and British enterprises, but managed by Scotch shepherds, who have a natural aptitude for the industry. On fifty extensive ranches graze the millions of animals that grow heavy fleeces of high-grade wool and that supply annually about 1,200,000 head of sheep and lambs to the half-dozen freezing plants in the Punta Arenas regions.

Most of the sheep are cross-breeds in which the Merino and Romney Marsh characteristics are dominant. They furnish both mutton and wool. Mutton to the extent of about 25,000 tons per year moves from this part of Chile to the United Kingdom. Owing to a cool moist climate and selected breeds of sheep, heavy fleeces of eight to ten pounds are sheared, and the wool has fine texture and low specific gravity, distinctive qualities which make it valuable for fine grades of goods (Fig. 12).

A marked increase in the exports of either mutton or wool is not likely, for all the better pasture lands are already leased or owned for this purpose and some ranges have reached their maximum carrying capacity and are on the decline. The sheep industry of this region, because of isolation from the rest of the country, has no contact with other activities of the Republic; between it and Central Chile lies a highly articulated coast washed by stormy, treacherous seas. As a result, the frozen mutton and wool exports reflect chiefly the localized trade of the Punta Arenas region and do not add materially to the purchasing power of the country as a whole.

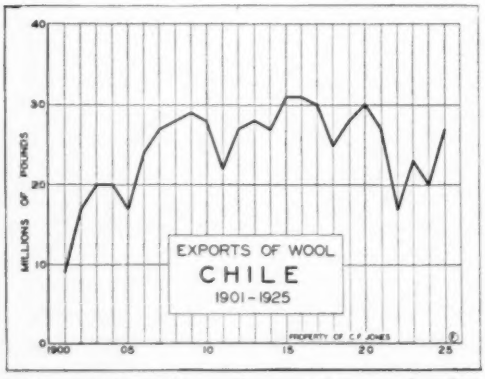

FIGURE 12.—The wool exports increased rather rapidly from about 10 million pounds in 1910 to 30 million pounds in 1915; since then the shipments have averaged about 25 million. With favorable conditions, Chile can supply this quantity and probably more.

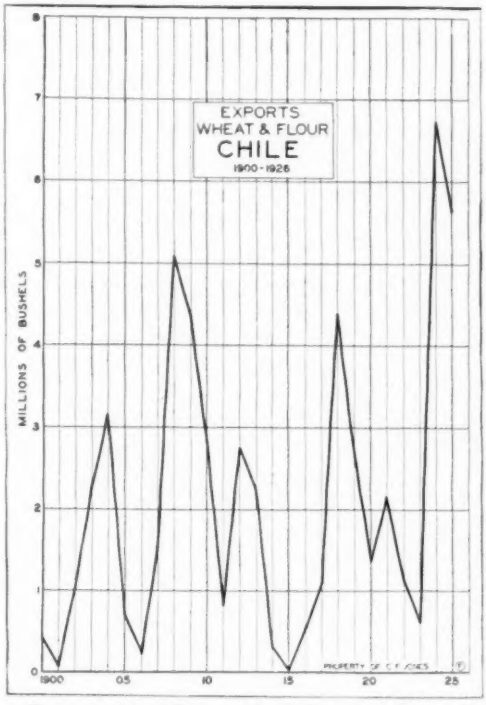

FIGURE 13.—The marked fluctuation is the chief characteristic of the export movement of Chilean wheat and flour.

Wheat and Flour

Wheat, one of the leading exports during the first half of the nineteenth century, now occupies a minor place with only 2 per cent of the total value. The exports registered an actual decrease since 1880 in the face of greater home consumption and competition with the chief world wheat-producing regions which use up-to-date machinery of all kinds. In wheat, more than in any other Chilean commodity, the shipments show exceedingly marked fluctuations in spite

of the fact that alluvial soils and the Mediterranean climate in central Chile are almost ideal for the production of grain of good quality (Fig. 13). From 1900 to 1925 the years of large wheat exports from Chile corresponded rather closely to good crop years in Chile or to one or more small crops in other wheat regions of the world, especially those of Argentina and Australia. The wheat moves chiefly to northwestern Europe and the flour to Bolivia and Peru.

In addition to the preceding agricultural exports, Chile sends out small amounts of barley, oats, beans, peas, some fruits, and hides and skins. Contrasted relief, soils, and climates permit the growth of nearly all subtropical and temperate zone crops; but extensive production as in the prairie plains of Canada or the Pampa of Argentina is not possible. The small area of agricultural land squeezed in between the Coast Ranges and the Andes, the desert stretches of the north, the drenched headlands of the south, under present conditions of land tenure and methods of cultivation, prevent agricultural commodities from figuring prominently in the export trade. Yet as the minerals wane in importance and as the extensive land holdings break up, these products will assume a more significant rôle in the commercial life of the Republic.

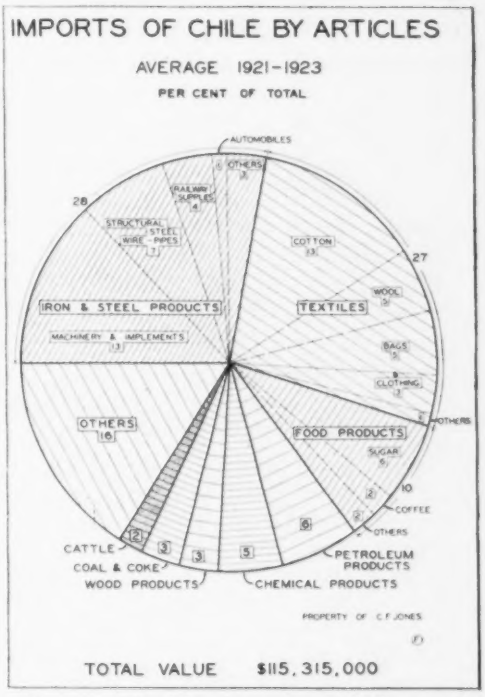

FIGURE 14.—The imports of Chile consist largely of manufactured wares from northwestern Europe and the United States. Yet 10 per cent of the purchases consist of food products chiefly from South American Republics.

THE IMPORT TRADE

While the exports of Chile consist entirely of products of the mines and the lands, the oversea purchases are made up of manufactured wares of a great variety, in spite of the fact that Chile, of all South American countries, except possibly Brazil, is best equipped for the development of manufacturing industries. Its resources of iron ore, copper, water power, coal, and forests; its wool, hides, wheat, and grapes; its invigorating climate, its active population and progressive policies, all favor manufacturing enterprises. On the other hand, lack of capital, technical skill, and an active market have restricted industrial development. Only 6,000 small establishments turn out a minor fraction of the requirements in manufactured wares and these mostly in special lines.

The leading Chilean manufacturing industries, both in point of invested capital and production, are those connected with foodstuffs (flour mills, sugar refineries, meat and dairy establishments, and bakeries), leather goods, clothing, electricity, beverages, and lumber mills. In some of these lines, the mills supply the domestic demand, which is not large, as only a few million people are involved. With few exceptions, Chilean manufacturing industries cannot produce economically articles made by complex and expensive machinery and skilled labor, or those in which quantity output is essential to economical production. Furthermore, Chile lacks certain essentials for the production of the basic iron and steel goods, despite the resources in coal and

high-grade iron ore, such as coking coal, important alloy minerals for special kinds of steel, and capital for the development of mines and the erection of furnaces. The absence of fuel or power of any kind in proximity to the best ore deposits, and inadequate transportation facilities are serious drawbacks.

As a result of all these conditions, Chile must look to foreign sources for its major supplies of iron and steel products, textiles, and other manufactured wares. Foreign companies engaged in the production of the chief exports naturally look to the home country for their supplies and equipment.

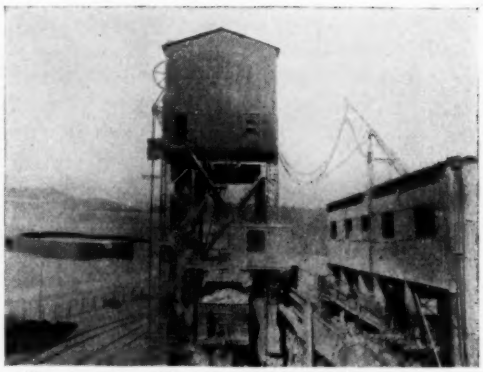

FIGURE 15.—The powerful dumping apparatus and the dinning ore crushing machine at Chuquicamata. The derrick lifts the railway car and dumps the contents into the chute leading to the crusher.

IRON AND STEEL PRODUCTS

Iron and steel products constitute the leading group of commodities imported into Chile with 28 per cent of the total (Fig. 14). They are required chiefly by the industries and activities connected with the production and transportation of the chief export commodities. Nitrate properties, copper camps, railways, and port and city development work take the bulk of the imports, although foreign iron and steel products of one type or another touch almost every phase of Chilean life.

Machinery and Tools

Mining machinery and tools during the last few years have constituted about one-half of the total imports of iron and steel, consequent especially upon the active world demand for copper, the extensive development work being carried out at Chuquicamata, Sewell, and Potrerillos, and the operation of smaller mining properties. In this line of goods huge ore crushing and sorting machines, quarrying, and smelting machinery occupy a leading rôle (Fig. 15). The demand for these wares will continue as development work grows and as old machines require repair or replacement, although some of the companies have plants for the complete overhauling of machines. The leading copper properties are controlled chiefly by American interests that depend upon high-grade equipment from the United States.

Construction and conveying machinery of a considerable variety occupies a prominent place in the machinery trade. These lines of goods are required chiefly by the copper camps, nitrate *oficinas*, and port and city construction companies. In recent years, construction equipment is being used, in spite of cheap labor, by the more progressive engineers and contractors of the principle cities.

Special types of industrial machines, used in small but expanding manufacturing industries of central Chile, enter the import trade in increasing quantities. Among these lines are knitting and spinning, flour mill, shoe, cigarette, sawmill and woodworking, brewery, and sugar refining machines. The significance of these imports is apparent when it is stated that Chile supplies practically all her requirements of flour, leather boots and shoes, cigarettes, beverages, and refined sugar.

Electrical machinery to the value of about four million dollars per year enters Chile. Every town of any importance in the country has a central station, consisting of one or more generators driven by crude-oil engines in the north and water wheels in the south. While electrical goods are widely distributed the bulk of the trade goes to the chief cities, as Santiago, Valparaiso, and others, and

to the chief mining companies; the plant at Chuquicamata is run on power generated at Tocopilla on the coast. A central station at Cruz Grande furnishes the power for the iron mines at Tofo, and the Braden Copper mines are operated by power from the hydro-electric plant at Coya. Imports of electrical machinery certainly will increase, since one of Chile's greatest resources lies in the water power of the Andes of the central part of the country and since many towns and manufacturing industries in this section can use quantities of electrical energy.

FIGURE 16.—The low purchasing power of most of the rural population of Chile and the indifference of the large landowner towards the improvement of methods of agriculture restrict the use of most kinds of modern farm implements. Plowing with a crude implement in a coastal valley near Santiago.

Despite the fact that three-fourths of the population of the Republic is supported by the agricultural activities of central Chile, and that climate, relief, soil, and the crops cultivated favor the general use of modern implements and machinery, they are little used and amount to a small figure in the import trade, owing for the most part to the system of land tenure and the agricultural methods employed. Agriculture in Chile is based on an extensive landholding system, except in a few northern irrigated valleys and in some outlying southern districts, and on the great number of illiterate farm laborers attached to nearly every estate. The attached laborer or tenant—always without means—decides how the farm work shall be done. The landowner, who in many instances is not directly concerned with the direct management of the farm, takes little interest in farm work, and is not willing to purchase modern implements that will make the work of the *roto* too easy and increase his idle hours. Poor methods of agriculture allow a profuse growth of weeds and prohibit the use of up-to-date implements that would simplify work on the larger estates (Fig. 16).

However, an increasing shortage of labor in the rural districts, caused by inducements of higher pay and sanitary working and living conditions in mining camps and in infant manufacturing industries, and an agricultural evolution in the central valley, will open a considerable market for agricultural machinery.

FIGURE 17.—A small part of the copper plant at Chuquicamata, the largest plant in the world for the treatment of low-grade oxide copper ores. Plants of this type require the major Chilean imports of iron and steel goods.

Structural Steel—Pipes

The rather prominent place structural steel holds in the import trade results from the huge requirements of enormous copper camps (Fig. 17), nitrate *oficinas*, and port and hydro-electric power developments. The demand for this line of goods fluctuates greatly from year to year according to the activity of the preceding industries.

Chile has spent during recent years about one and one-half million dollars per year for steel pipes which are used in connection with the mineral industries of the desert and transportation. Potrerillos, the newest big copper camp in Chile, gets water from Andean snow

FIGURE 18.—Sheep quite generally distributed throughout central Chile supply a medium grade wool for a considerable domestic woolen industry.

fields sixty miles away. Most nitrate plants and many coastal cities of northern Chile draw their water supply through steel pipes from the high Andes more than one hundred miles distant.

Railway Supplies

Railway supplies, which constituted in 1921–1923 about 4 per cent of the total imports, went chiefly for replacement on existing lines, although numerous short branches from the longitudinal railway to mines or to ports were under construction. In contrast to other iron and steel goods, Belgium led in this trade with one-third of the total. Increased railway expansion and improvement in transportation facilities will call for greater quantities of rail equipment.

Automobiles

While automobiles constitute in value one per cent of the total imports, Chile is not a major market for them. Trucks are little used owing to the inexpensiveness of draft animals and the small area covered by the business districts of the towns. The use of pleasure cars is restricted because of (1) the lack of good roads in the country, even in large cities, except for special sections, (2) the requirement of a chauffeur for social distinction and for protecting the car, (3) the lack of skilled mechanics, (4) the high price of gasoline (40 to 50 cents per gallon), and (5) the low purchasing power of most of the population.

The present demand of the Chilean market amounts to about 850 cars per year. Nearly all sales consist of low-priced and medium-priced light American cars that can be used with a fair degree of success on the rough surfaces encountered on all roads except the principal streets of the cities.

While Chile has many advantages for the development of a domestic iron and steel industry, and while plans have been completed for a hydro-electric plant for the production of steel, the Republic will continue to depend for some time upon foreign sources for requirements. The major imports of machinery, structural steel, and railway supplies must come forward to keep in motion the chief currents of the export trade.

TEXTILES

As in other South American republics, textiles occupy an important place in the import trade, constituting 27 per cent of the total. The chief textile requirements of the whole country come from foreign sources, except for cheap cotton fabrics and a variety of woolen articles, produced under protection of a significant tariff barrier. Domestic mills make no attempt to manufacture the finer goods of either cotton or wool.

Cotton

Cotton goods and clothing constitute one-half the textiles imported into Chile. They are especially suited to the subtropical climate of the northern desert and even to the Mediterranean section of Central Chile, with its long hot summers and short mild winters. They lie within the purchasing power of the lower classes who dress in cotton fabrics through the entire year in most sections of the country. Chile produces little cotton, and domestic mills, even with the protection of a high tariff, supply only a small part of the textile requirements made from foreign raw materials, except in trouserings and drills and in low-grade cotton hosiery. Ninety per cent of the consumption of the latter comes from local plants. As a result, the imports include the whole range of cottons from the gray tickings and unbleached sheetings through the low-grade striped, checked, and plaid ginghams to fancy voiles and cotton-silk mixtures.

In the cotton textile trade keen competition exists among all the important cotton manufacturing countries. The United Kingdom has about one-half of the total trade, while the United States, France, and Germany compete for second place. British and German houses have acquired a prestige through many years of serving the Chilean market, a prestige

which contributes to success. British firms carry consignment stocks of a wide range, giving them an advantage over competitors who sell for future delivery. Large numbers of British in Chile prefer the home product. France ships especially fancy goods and novelties while Japan recently has supplied unbleached goods—sheeting, drill, jeans, and shirtings of inferior quality at 10 to 15 per cent cheaper than American cottons. In spite of keen competition, the Chilean field offers one of the best markets in South America for cotton textiles.

Wool

Woolen textile receipts constitute about 5 per cent of the total imports of Chile, although (1) sheep are quite generally distributed through central Chile and concentrated in the extreme south, (2) the country exports annually about twenty-five million pounds of wool, and (3) the manufacture of wool cloth is an important industry in the Republic (Fig. 18).

Several domestic mills using medium to low runs of wool, employing cheap local labor, and protected by a high tariff, turn out most of the suitings and dress goods worn by the middle and lower classes. As a result, woolen imports consist largely of high-grade woolens of medium to light weight types, more suited to the climate than heavy materials; they are demanded by the well-to-do. The woolen goods trade rests principally in the hands of British, Belgian, French, and German houses which compete actively for the trade. The rapidly growing Chilean woolen industry is making strong efforts to secure greater protection; if successful, the imports of this class of goods probably will decrease.

Bags

Each year interests in Chile pay out seven million dollars or more for bags in which to ship nitrate, metals, wool, meats, flour, and even parcel post packages for protection against pilfering. Almost three-fourths of this goes into jute cloth and bags from British India and the United Kingdom, countries that have a world monopoly on this essential cheap material. Incidentally, it is worth noting that the refusal of the Chilean government to allow nitrate producers to reimport free of duty sacks in which they have exported nitrate places an additional burden on the industry.

FOOD PRODUCTS

Like the leading classes of imports, food products include a long list of commodities which come from all parts of the world. The bulk of the trade, however, consists of sugar, coffee, rice, tea, cacao, and yerba maté—products which Chile cannot produce owing to climatic conditions.

This is the only class of goods which Chile procures chiefly from sister republics of South America. Sugar comes from the irrigated valleys of the Peruvian coastal desert as "raw crude" and is refined in Central Chile for distribution to all parts of the country. Coffee from Brazil and Ecuador, tea from British India, cacao from Brazil and Costa Rica, and yerba maté, reëxported from Argentina, are consumed to the extent of about four million dollars per year. No great growth is to be expected in this trade since it depends upon the purchasing power and consuming capacity of a rather static population. Yet Chile cannot produce these commodities, so that all requirements must come from foreign sources.

PETROLEUM PRODUCTS

Petroleum products receipts constitute 6 per cent of the total imports. While a variety of commodities come in, more than four-fifths of the trade consists of fuel oil chiefly for the nitrate *oficinas* and copper camps of northern Chile as well as for the railways and ship bunkering. In the section of the country south of Santiago, little petroleum is used either for railroads or industries owing to the native coal supply of the coastal zone

and the water power of many streams plunging down the high Andes.

During the last fifteen years, fuel oil has largely replaced coal as a fuel in the nitrate industry; this industry consumed in 1910, 613,000 metric tons of coal and 110,000 tons of petroleum, but in a recent year the figures were: coal, 100,000 tons and petroleum, 670,000 tons. Oil has distinct advantages over coal as a fuel. Many nitrate ports equipped with modern facilities for handling oil receive it in huge tanks from ships in the harbor through long pipes and deliver it to the nitrate railway tank cars. A tank steamer can unload 7,000 tons of oil in a few hours, while a steamer with four hatches takes eleven or more days to deliver an equal tonnage of coal. Merchandizing methods favor the use of oil; oil is shipped to the ports by the producers, held in store by them and delivered directly to the consumer, while coal passes through numerous agents, brokers, exporters, wholesalers, and retailers. Under these conditions coal cannot compete with oil as a fuel in the nitrate industry in spite of an important movement to this region of cargo ships with light loads or with coal as ballast.

Mexico, Peru, and the United States supply practically all the petroleum products. The major part of the fuel oil comes from Mexico, while the United States furnishes most of the refined products, and Peru the Diesel oil and some gasoline and kerosene.

FIGURE 19.—The result of a blast on one of the loading levels at Chuquicamata where 400 tons of explosives were loaded and fired in a single shot.

CHEMICAL PRODUCTS

In spite of the possession in considerable quantities of some of the basic raw materials of the chemical industry—such as nitrates, iodine, sulphur, and borates—the imports of chemical products amount in value to 5 per cent of the total import trade. This class of goods includes industrial chemicals, paints, explosives, medicinal and pharmaceutical preparations, and dyestuffs.

Among the industrial chemicals caustic soda and calcium carbide take the lead, the former constituting about three-fourths of the total receipts. It is used chiefly for the manufacture of soap and also in making disinfectants and cleaning solutions, which are extensively used,

and in the preparation of surfaces for repainting.

An active market exists in Chile for paints and varnishes of many kinds. In comparison to the size of the country and its population, relatively large quantities are consumed each year. Municipal laws in nearly every Chilean city requiring the painting of buildings once a year naturally create a demand. The high cost of wall paper increases the use of water paints for interior use. Ready-mixed paints are not widely used by the professional painters, who buy paste, oil, and drier, and mix their own paints; they often add cheap materials that produce a paint of poor lasting quality, necessitating repainting in a short time.

Each year mining interests and construction concerns in Chile pay out one million dollars or more for explosives. The chief consumers, the nitrate *oficinas* and the Chile Copper Company at Chuquicamata, set off thousands of tons of explosives on a scale without parallel in the annals of mining (Fig. 19).

Chile, not an important producer of crude drugs, herbs, etc., looks to foreign sources for drugs, medicines, and pharmaceutical products, to the extent of about one and a half million dollars each year. The import products are distributed throughout the country; a large portion of the population uses nostrums, owing to expense or inavailability of medical advice and the general lack of sanitary safeguards towards the prevention of disease. As in most other South American republics, a liberal use is made among all the members of the upper classes of society of toilet preparations and perfumes.

While Chile is not a major market for dyestuffs, the demand increases rapidly with the expanding textile, leather, shoe, and hat industries, and the imports aggregate to considerable sums.

In the chemical products trade, keen competition exists between Great Britain, United States, Germany, and France, countries which supply nearly all the requirements. While these countries have a hand in the trade of most of these articles, the United Kingdom leads in "sodas and sodium compounds" (with 85 per cent of the total) and in paints, the United States in explosives (85 per cent of the imports), certain drugs, varnishes, and enamels, Germany in drugs as a whole and dyestuffs, and France in toilet preparations and perfumes. France and England, in the field a long time, have an excellent reputation with old customers, so that articles of certain brands practically sell themselves. Chileans are reluctant to make changes. Germans are at their old practice of supplying cheap goods at reduced prices on long term credits aided by large sums of money spent in advertising and in keeping representatives in the field, while the United States producers attempt to capture the market against the currents of competition by furnishing goods of superior quality.

WOOD PRODUCTS

While the south central part of Chile contains forest resources of both hard and soft wood trees suitable for practically all purposes, the lumber industry is in its early stages and exists only for a domestic market, little effort having been made to create an active foreign demand for Chilean woods. At the same time, the purchases of foreign timber products amount to 3 per cent of the total imports.

Imports of wood products consist of two types. Almost 90 per cent of the receipts of wood products consist of paper. Chile, the third consumer of paper in South America, has only a few active paper mills that turn out cheap grades of paper and cardboard and consequently depends on foreign sources for four-fifths of the requirements. Paper materials come chiefly from northern Europe; two-thirds of the total are supplied by Sweden, Norway, and Finland. As Chilean forests contain good pulp wood, the growth of a wood pulp industry, aided by cheap water power, may cause a decline in the paper imports, al-

though it will be several years before this can take place.

Douglas fir from western United States is the only timber entering Chile in quantities. Its great lengths and superior strength compared to Chilean substitutes create an active demand for it as joists, beams, boards, and mine timbers. It is being employed extensively in the mineral regions, in the area devastated by the earthquake of 1922, and in the cities which have renewed construction programs after a dormant period during and following the war.

With the expansion of the domestic timber industry of Chile during the last decade, the imports of lumber have decreased notably. Foreign hardwoods, especially oak, and California redwood, both of which formerly entered Chile in considerable amounts, have been replaced by native timber of somewhat lower grade but selling at 10 to 20 per cent cheaper than the foreign products. At present, *Araucaria imbricata* replaces Douglas fir in many uses; its durability equals that of Douglas fir and it retails for only 60 per cent of the price of the imported wood. With improved methods of lumbering, milling, and transportation, and a greater use of water power, Chilean lumber probably will replace foreign woods within a short time.

COAL AND COKE

Although Chile has the chief deposits of coal in all South America, and leads the other republics in production with an annual output of about 1,400,000 tons, it supplies less than half the fuel annually consumed in the country. The coal fields of Chile at Lota and Coronel lie near the sea, are easily worked, and easily accessible to central Chile, but the subbituminous coal produced is suitable only for use on railroads and steamships.

Foreign coal and coke make up 3 per cent of the total imports. They are consumed especially by nitrate *oficinas*, copper camps, and railways of northern Chile. Coal moves to the nitrate ports from the United Kingdom and the United States at very low rates in vessels seeking nitrate cargoes, and from Australia in schooners which have carried lumber from Puget Sound to Australia.

The foreign coal trade of Chile has decreased rapidly from slightly more than 1,500,000 metric tons in 1913 to 175,000 tons in 1925. A number of factors have contributed to this decline. In central Chile, the leading consumer of foreign coal until the end of 1914, coal has been replaced by domestic coal from nearby fields and by water power. In the northern desert, the chief consumer of foreign fuel since 1914, coal has been replaced by fuel oil. At the nitrate ports coal is sacked, weighed, and transferred to storage sheds by lighters as no ports are equipped with wharves and docks and handling machinery. From the warehouses, it moves to the nitrate fields on flat cars in sacks. On the other hand modern facilities and equipment handle petroleum. If present tendencies continue, the Chilean coal market will continue to diminish.

TRADE BY COUNTRIES

Chilean exports are widely distributed throughout the world; fourteen countries take one per cent or more of the shipments. Four nations—United States, United Kingdom, Germany, and France—purchase more than three-fourths of the total (Fig. 20). These same countries, with Belgium and Peru, supply 80 per cent of the imports (Fig. 21). As in other South American republics, a marked redistribution of the trade has taken place since 1910. The United States has moved, in both exports and imports, from third to first rank, replacing United Kingdom and Germany, leaders in the trade for decades.

UNITED STATES

The United States' trade expansion in Chile, which began long before the World War, received a great impetus from the abnormal conditions of the war period. Just before the war, the United States took 18 per cent of the exports of

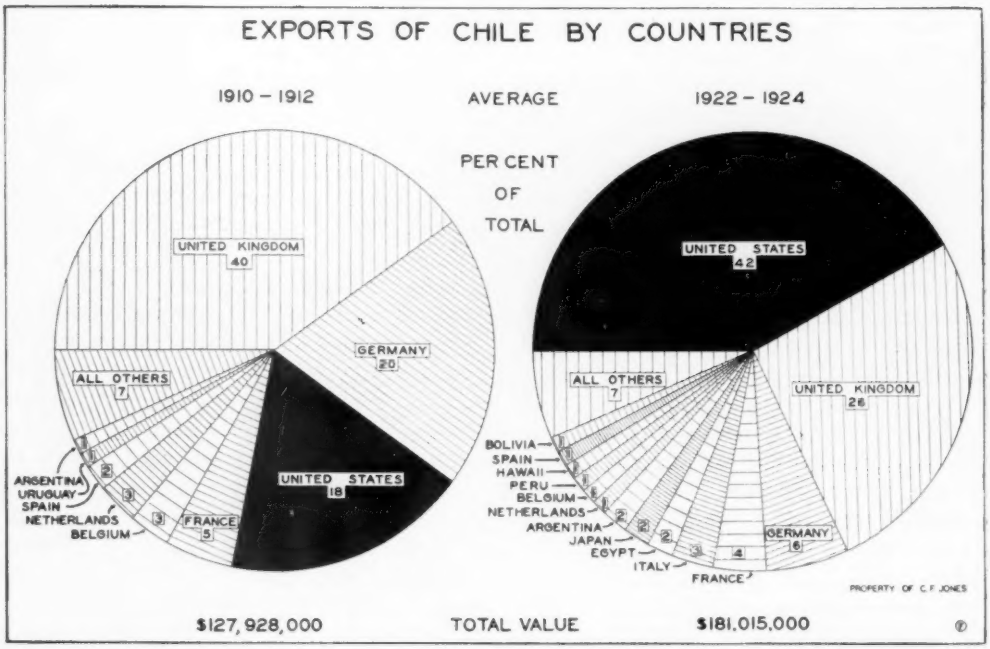

FIGURE 20.—Four countries take 78 per cent of the total exports of Chile. A marked re-distribution of the trade took place between 1910–12 and the present. Germany and the United Kingdom decreased greatly while the United States advanced to first rank, taking 42 per cent of the total exports in 1922–24. Germany, the leading consumer of Chilean nitrate before the War, now supplies its demand with the synthetic product.

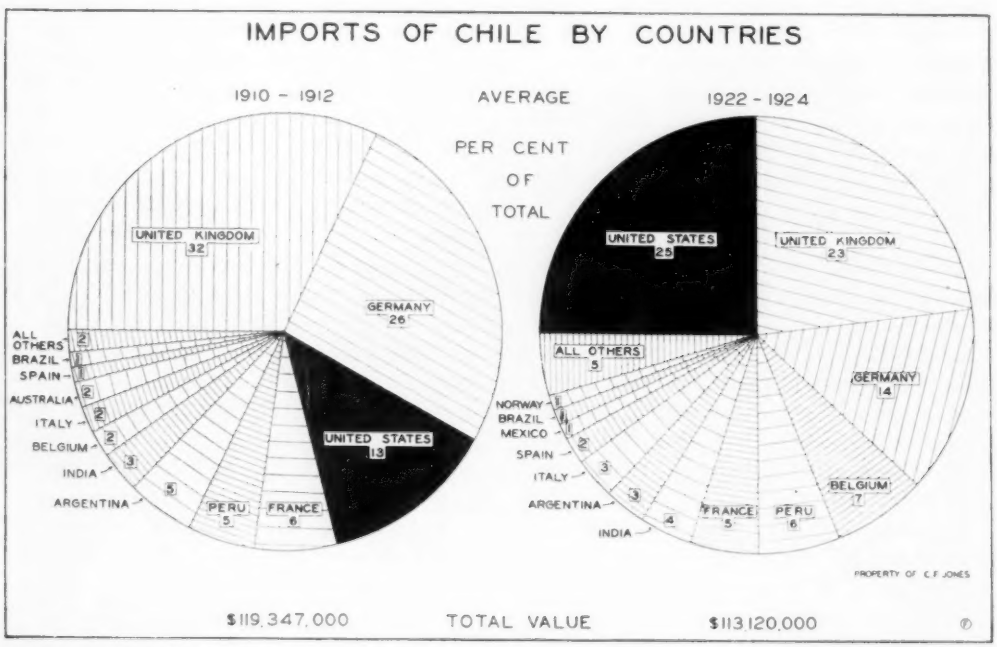

FIGURE 21.—The United States and the United Kingdom, the leading manufacturing nations of the world, supply almost one-half the Chilean oversea purchases. The advance of the United States in supplying Chile with manufactured wares constitutes the most striking development in the Chilean import trade since 1910.

Chile and supplied 13 per cent of its foreign purchases; in 1922–1924, the United States bought 42 per cent of Chilean exports and furnished 25 per cent of the imports.

In addition to the fact that Chile produces raw materials required by the industries of the United States and that much trade inevitably fell into its lap during the war, a number of unusual conditions have aided in this remarkable trade expansion. The opening of the Panama Canal placed the United States in a better position from the standpoint of shipping than other manufacturing nations. Goods ordered from New York by cable at Santiago may be delivered in thirty days; rival countries of the United States require from forty to sixty days. The establishment of American banks and credit information companies, the completion of the direct, American-owned cable service between the West Coast and the United States, the building up of a feeling of trust and confidence in American goods and business methods after the detrimental activities of the mushroom exporters of the war period, and heavy investments in Chile have all played their part in this commercial movement.

Of the preceding advantageous developments probably the most influential were the American investments in Chilean enterprises. Until 1908, when American capital began to enter the mining industry in a large way, the total investments of United States' interests amounted to less than $25,000,000. They now total approximately $440,000,000; they are distributed as follows: $270,000,000 in mining properties, almost $100,000,000 in Chilean loans, $40,000,000 in the nitrate industry, $22,500,000 in merchandising, $6,000,000 in manufacturing, and the remainder in banking and transportation. Thus American investments in Chile equal about $100 for each inhabitant of the Republic.

No stronger trade bond exists than investments in reciprocal resources. The United States takes more than half of the exports of nitrate and copper, and all the iron ore (Fig. 22). In return, this country leads in supplying mining machinery, structural steel, electrical equipment, agricultural implements, automobiles, certain classes of railway equipment, textiles, chemicals, and petroleum products.

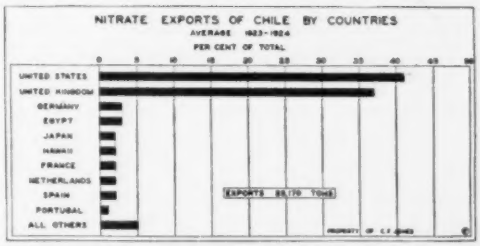

FIGURE 22.—Before the War, Germany was the chief purchaser of Chilean nitrate. Now the United States and United Kingdom take 78 per cent of the total shipments. Germany supplies most of its requirements with synthetic nitrogen from domestic plants.

In spite of this dominant trade position, commercial concerns of the United States face serious problems. The Chilean merchant is chiefly an inveterate price buyer; American products, for the most part, are not made for price cutting. European shippers allow *a 90 day acceptance draft*, while most North American exporters insist on *cash against documents in New York*. Europeans, long in the field, supply goods suited to the peculiar whims of the market, while American manufacturers often attempt to force a product onto the market, even though it be only slightly different from what the customer wants.

However, the favorable developments during the last twenty years in the face of these disadvantages indicate that the United States will hold the dominant position in trade in spite of keen competition from European concerns. But to do this, American capital must continue its interest and investment in Chilean enterprises and its cultivation of the commercial field.

UNITED KINGDOM

The United Kingdom ranks second as a purchaser of Chilean products and as a source of imported wares; it takes 26 per

cent of the former and supplies 23 per cent of the latter. It takes one-third of the nitrate, iodine, and borax shipments, and more than one-half of the wool, wheat, and barley, and practically all the frozen mutton. In return, the United Kingdom supplies about one-third of the total textile receipts, and significant quantities of most of the manufactured wares in the import list.

The United Kingdom, for a long time a manufacturing nation looking to foreign fields for raw materials and markets, has a strong material basis of trade with Chile, a producer of raw products and foodstuffs. British activities have aided the natural expression of this material basis of interchange of goods. As in other parts of South America, they were the first to enter the Chilean commercial and investment field in a large way, and to the advantage of an early start they owe much of their success. They have a splendid system of distribution; the members of a large English population are well established in all parts of the country and naturally give preference to British-made goods, which have enjoyed for many years an excellent reputation. Since the Chilean is accustomed to purchasing and using a certain brand of goods, many old British lines practically sell themselves. Furthermore, as the leading foreign investors in Chile, the British have had a powerful influence in directing the currents of trade.

The total British capital invested in Chile amounts to almost one-half billion dollars. It penetrates nearly every phase of the financial, industrial, and commercial life of the Republic. Of the total, 32 per cent is represented by government and municipal loans, 20 per cent in railways (40 per cent of the capital invested in all the railways of Chile is British money), 15 per cent in tramways and electric companies, and 13 per cent in nitrate and mining.

With all the advantages of an early start, a favorable basis for interchange of goods, an active resident population, and mounting investments, the British stand in a position to hold a prominent place in Chilean commerce; they may even crowd the United States as the principal source of a variety of good quality manufactured wares for the Chilean market.

GERMANY

Before the war Germany held a strong position in Chilean commerce with almost one-quarter of the total. It was the chief consumer of nitrate, taking about one-third of the total, and was the leading source for several manufactured commodities. In some lines, it had a monopoly—dyestuffs, cement, certain chemicals, cheap grades of iron and steel goods, and aluminum ware.

As in other South American countries, Germany lost most of the Chilean trade during the war, but it has recovered remarkably. Now Germany buys 6 per cent or more of the exports of Chile and furnishes 14 per cent of the total imports. That war-broken country has become again a formidable competitor in certain classes of dyestuffs, chemicals, paints, steel products, machinery, and railway supplies.

This remarkable gain grew out of a number of conditions. The German Colony is one of the largest and most influential in all Chile; old German banks came through the war period successfully; the local distributing system in the country remained intact, in spite of the fact that the German merchants had to turn to foreign countries for a short time after the huge stocks of German goods, which were purchased before the outbreak of hostilities, gave out. In addition, the reëstablishment of Gernam shipping lines has given that country a distinct advantage over any of its continental rivals. Furthermore, a feverish activity of numerous representatives of German manufacturers in courting prospective Chilean customers by furnishing cheap, attractive goods at cut rate prices and on long-term credit is gaining an increasing market for German wares at the expense of competitors. Just how far this policy can carry

German trade, no one knows, but the chief condition favoring the trade is that Chile remains primarily a price market.

FRANCE-BELGIUM

The trade between Chile and France illustrates the same principles as that of the United Kingdom only on a much smaller scale. France buys raw materials and foodstuffs and supplies manufactured wares. The bulk of the shipments to France consists of nitrates, wool, and wheat. Chilean purchases from France consist largely of silk goods, modes, perfumes, and pharmaceutical products, commodities for which the French have a wide reputation; for that reason they dominate the trade in these lines.

The rapid rise of Belgium in the import trade of Chile during recent years resulted from its shipments of railway equipment (Belgium led in 1924 with 40 per cent of the total), glassware, textiles, and certain classes of machinery.

INTRA-CONTINENTAL TRADE

Chile buys about 10 per cent of its imports from neighboring Republics, but sells not more than 5 per cent of its exports to those countries. These imports consist largely of sugar from the irrigated valleys of Peru, cattle and yerba maté from Argentina, and coffee and cacao from Brazil and Ecuador, while the exports are wheat-flour and reëxports of coal, oil, and bags to Bolivia, and wheat-flour, wood products, and legumes to Peru. The intra-continental trade, based largely upon differences in climate, should increase with the development of contrasted regions.

THE READJUSTMENT

The union of Bolivian and Peruvian territory with Chile as a result of the War of the Pacific gave birth to the period of great expansion in the commerce of that remote Republic. By this political maneuver, Chile gained the nitrate fields, the major copper properties, and the borax and iodine resources from which the country extracts fully three-fourths of the total exports. To this region move the major imports. Thus to the activities of the mineral industries of the north, Chile owes much of its commercial growth and its present commercial importance. To it the Republic has looked for forty years for more than half the total government revenue. But how long can this region continue to dominate Chilean trade and finance, or how long can the country depend upon it for its commercial position among South American Republics?

The mineral deposits will be exhausted. It is estimated by competent authorities that the major copper reserves will have been utilized by the end of the present century. While other copper deposits may be discovered, it is not likely that huge reserves, sufficient to provide a copper export movement of a large tonnage much beyond that time, will be uncovered. The nitrate industry, too, working at the rate of production during 1924 and 1925 and by the same methods, will deplete the major reserves in about one hundred years. However, the critical factor in the nitrate industry is not the quantity of nitrate available but the influence of competition by synthetic nitrogen on the ability of Chilean producers to dominate the world nitrate trade.

In 1894 Chilean nitrates supplied 73 per cent of the world's demand, in 1913–1914, 53 per cent, but in 1925–1926 only 26 per cent. At the present time, most of the nitrate plants are closed down, while artificial producers continue actively. If the plants are to resume production at the rate of the prosperous years, significant readjustments must be made. Nitrate must be produced at a lower cost and delivered to the consumer at a lower price. Happily, the perfection of new processes already indicates cheaper production. But with this must go a marked reduction of the present $10 per ton export tax and less ill-advised manipulation of prices, shipments, and sales by the Nitrate Producers' Association.

In any event, the exhaustion of the mineral deposits, or decreased production and exportation owing to political interference with the free-flowing currents of trade, will rob Chile of its chief commercial products of the present, and cause an exodus of population and capital and a general decay of industry in the northern region. On the other hand, though the removal of the export tax on nitrate would enable Chilean producers to reopen the nitrate plants and to compete favorably in world marts with artificial nitrogen producers, it would take away the most important source of government revenue.

If the nitrate industry collapses or if the export tax is removed, to what source can the government turn for its necessary revenue? While the nitrate industry poured forth millions in taxes, sources of revenue regularly depended upon by other governments remained untapped. Upon the good agricultural lands of Chile, all held in huge estates by less than one-tenth of the population, even a small tax would not only furnish considerable revenue for the government but would bring about an advantageous division of these enormous holdings, induce in time a redistribution of the land among many more people, bring into productivity a great deal of fertile land now lying idle (only one-third of the available farm land is used profitably for agriculture), elevate the standards of living of a major part of the people, and increase materially the productive capacity and purchasing power of the middle and lower classes.

Furthermore, such an evolution would pave the way for a more rapid utilization of the other resources of Chile. Although the landed aristocracy, holding the reins of government, may evade any major readjustments for a while, the movement of progress is under way. It is only a matter of time until the sunny lands of Mediterranean Chile, the coal and mineral resources, the potential power of the numerous sparkling streams from the snow fields and glaciers of the high Andes of central Chile, the tranquil forests, and the oppressed Chilean *roto* combine to expand the agricultural, industrial, and commercial activity beyond the dreams of the present government and to enrich the financial, political, and social life of the country.

SIBERIA—THE STOREHOUSE OF THE FUTURE

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"SIBERIA, a land of snow and sables," was never a wholly true slogan though it described fairly accurately the mental picture of the largest area in the temperate zone still awaiting development. What progress takes place, when it will take place, depends on many things; but the resources

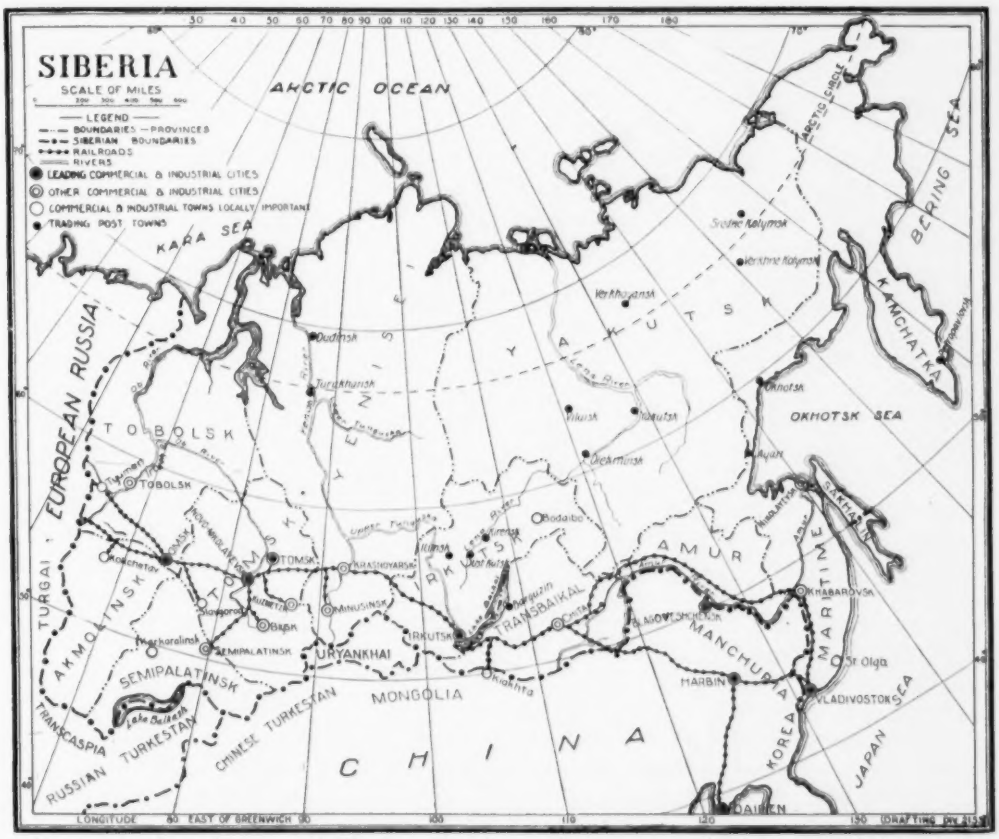

FIGURE 1.—Location map of Siberia. The thousands of square miles between Tobolsk and Okhotsk, between Verkhoyansk and Irkutsk, comprise an empire in the making, rich in resources, lacking in transportation and markets and thinly populated, but a potential El Dorado of raw materials.

country somewhat widely held until recently. Snow there is, to be sure, but not in vast, unbroken whiteness; sables were and are still to be obtained, but only with effort and now in much smaller numbers than formerly. "Siberia, a land of latent resources," is the more accurate, present-day description of the world's are there for development when the proper time comes.

Siberia's influence in world economics has thus far been insignificant, but, given a chance, the land will yet become an important factor in trade and commerce, bringing far-reaching changes with manifold effects. Once on a status favorable

for a free play of economic forces, Siberia may develop into a large producer and exporter of agricultural products, timber, metals and minerals, a sizable market for industrial articles, and a factor in transportation. It is the one large temperate area awaiting development.

When the problem of low-cost transportation to European, Russian, and foreign markets is solved, Siberia may raise and export very great surpluses of agricultural products such as wheat, oats, butter, bacon, wool, meat, eggs, bristles, hides, the appearance of which on the world market will necessitate readjustments in many countries. The stupendous expanse under forests, immense areas of which bear stands of high quality timber, may become a rich source of timber supply and influence world lumber markets. If the mining industry is developed, Siberia may ship its surplus of minerals and metals to European Russia and even to other countries and thus come out as a direct competitor on the world market.

However, development of agriculture, forestry, and mining on a large scale is possible only when the Siberian population is augumented through immigration. According to some estimates, the cultivable land in the southern part of Siberia still available may accommodate 4,000,000 farmer families, or about 20,000,000 people, in addition to the present population of about 15,000,000. Even this increase of population will not suffice to cover the full demand for labor; additional immigrants will be needed for manufacturing industries, transportation, and trade. They may bring the population to 40,000,000 or 50,000,000, thus creating a consuming market well worth the exporter's attention.

Siberia's railroads provide a three weeks shorter route than by steamer for passengers and mails bound from western Europe to China and Japan. Under normal conditions Siberia may also become a medium for transit trade to and from northern, central, and western China, if Siberian waterways are improved and the Kara Sea is made usable for navigation on a commercial basis.

LOCATION, AREA, AND ADMINISTRATIVE DIVISIONS

Siberia, located in the northern part of the Asiatic continent, is removed from commercial centers. Its southern boundary approximates the northern boundary of the United States. It is difficult of access, being bordered on the north by the inhospitable waters of the Arctic Ocean, frozen much of the time; on the northeast, by the bleak waters of the Bering and Okhotsk Seas, fronted by coastal ridges; on the south by the mountains and deserts of Central Asia. Its area is about 5,200,000 square miles, nearly twice as large as that of the United States, and stretching 5,000 miles from west to east and 2,300 miles from north to south, and this enormous area has been a paramount factor in retarding the development of the country, though in the future this large area may be an asset.

Siberia is usually divided into Western Siberia—Tobolsk and Tomsk Provinces and Akmolinsk and Semipalatinsk Territories; Central Siberia—Irkutsk and Yenisei Provinces, and Yakutsk Territory; and Eastern Siberia, or Russian Far East—Transbaikal, Amur, and Maritime Territories.

CLIMATE

The climate of Siberia is typically continental. The winter is long and very cold, but generally dry, with little cloudiness. Snowfalls, contrary to common belief, are seldom deep. The coldest month is January, with a mean temperature of −4° F. (In Verkhoyansk, Yakutsk Territory, this mean is −61° F., while the July mean is 60° F., giving an annual mean range of more than 120 degrees, probably greater than elsewhere on the face of the globe.)

The summer is comparatively warm, and therefore agriculture may extend very far north. The period of plant

growth is from May to October, the mean temperature of these months ranging from 53° F. to 60° F. Most of the precipitation occurs during June, July, and August, which may be regarded as summer months. The days then are very long, so that the total number of hours of sunshine during the growing season does not differ materially from those of more southern regions; consequently, plants grow much more rapidly there. Spring and fall are of short duration and are hardly distinguishable, except in the south. Economic factors such as lack of transportation facilities and scarcity of population have more to do with the absence of agriculture in many Siberian regions than have climatic obstacles.

FIGURE 2.—A winter scene in a northern Siberian village.

The severe Siberian cold does not affect unfavorably the health of the population, especially in the interior of Eastern Siberia, where the air is calm, skies are clear, and the light is bright. The northern and eastern coasts are less favorable though the skies are clear, for here strong winds make even moderate cold very disagreeable and the summer is often foggy, rainy, and humid.

Siberian precipitation is light, over most of the country amounting to 12 to 14 inches a year. It is the least in the far north, less than 8 inches, and increases toward the south, reaching 18 inches or more in the southwest and in the Altai region, and 20 or more inches in the Amur region. On the average 50 to 55 per cent of the annual amount falls during the summer months, thus making the rainfall available for crops. The daily precipitation is usually light. Droughts are characteristic of many parts of Siberia. The gentle gradient of the western plain makes the drainage slow, and in connection with the light evaporation, owing to low temperature, gives the country a humid aspect despite the small amount of precipitation.

TOPOGRAPHY

Two-thirds of Western Siberia is a plain, extending from the Urals to the Yenisei River and from the Arctic Ocean to the foothills of the Altai Mountains in the southwest. The largest rivers are the Ob and the Yenisei with their tributaries; their currents are very slow, owing to the flatness of the plain. In the north are frozen swamps, succeeded as one proceeds southward in turn by primeval forests, the agricultural zone, and the steppes. East of the Yenisei River, Siberia is mountainous. Plains are found only along the coast of the Arctic Ocean and in the Amur River basin. One of these is the Zeya-Bureya Plain. The largest rivers are the Lena, flowing north, and the Amur, flowing east. The

courses of the rivers in eastern Siberia are shorter and straighter, and the current swifter in comparison with those in western Siberia.

In general, Siberia may be divided into the following physiographic regions: Western Siberian Plain, from the Urals to the Yenisei River; Kirghiz Fold land, south from Western Siberian Plain; Altai and Western Sayan region, on the Chinese border; Pre-Cambrian rocks, primarily around Lake Baikal; Middle Siberian Plateau, roughly between Yenisei and Lena Rivers; North Siberian Plain, to the north from the Middle Siberian Plateau; borderland ridges of Eastern Siberia; Kamchatka, and Chukotsk Peninsulas, on the northeast.

SOIL, FLORA, FAUNA, AND THE NATURAL REGIONS

In Siberia can be distinguished four regions with contrasting native vegetation extending from east to west across the country. They are, beginning at the north, the tundra, the taiga, the forest-steppes, and the steppes.

THE TUNDRA OR FROZEN SWAMPS

The ever-present, perpetually frozen layer prevents the filtration of surface water into deeper strata; therefore the soil is saturated with water, forming swamps. The plants are mostly perennial herbs, low bushes, and dwarf birches, generally creeping on the ground. Moss in low places sometimes forms a cover five feet thick, being replaced by lichens in dry places. During the long and cold winter the tundra is inhabited by but few species of animals such as lemming, arctic fox, polar bear, reindeer, and polar partridge. In spring it is fairly alive with birds, particularly the long-legged waders and water fowl. These are followed by carnivorous animals—wolf, bear, ermine, weasel; and birds of prey, falcon and hawk. Clouds of mosquitoes make life miserable not only for human beings, but even for wild animals here and on the taiga. The waters of the Arctic Ocean and of Siberian rivers abound in fish, the most common being salmon, cod, and sturgeon, and also in oysters and crabs. The very sparse native population derives its livelihood from hunting and fishing, and reindeer raising.

THE TAIGA OR VIRGIN FORESTS

The taiga or virgin forests are by far the largest zone, extending across all of Siberia, with a width of from 600 to 1,500 miles. The precipitation is not high, but owing to the low rate of evaporation because of the forest cover and only moderately warm temperatures, the soil contains considerable moisture. The soil is "podzol" or ash-colored, having a low fertility. The forests consist mostly of conifers. The taiga is full of fur-bearing animals—bear, lynx, wolf, fox, sable, squirrel, hare, ermine, and of many species of birds. The taiga is very sparsely populated, mostly by native tribes subsisting by hunting, fishing, and in some places by livestock raising. The small number of Russian colonists are settled in the few towns and along river valleys, where patches of tilled land can be seen here and there. Mining of placer gold in widely scattered places is the most important industry of that region. The forests are used by the population for their own needs. Their commercial exploitation is as yet in its infancy.

THE FOREST-STEPPE OR AGRICULTURAL ZONE

In the forest-steppe or agricultural zone the soil is "chernoziom," which is a continuation of the famous black soil belt of European Russia. It is widest in western Siberia and becomes narrower toward the east, not reaching the Pacific Ocean. It is not a continuous one, but is broken in several places and this black-soil belt is naturally very fertile. Climatic conditions here are better than in any other region of Siberia. This zone is traversed along its entire length by the Trans-Siberian Railroad and the bulk of Siberian population lives there. The largest number of cities, towns, and

settlements are along the railroad line. The occupation of the population includes the raising of grains, dairying, livestock breeding, fishing, mining, and manufacturing. Commercially this is the most important section of Siberia.

THE STEPPES

The soils in the steppes are the so-called chestnut and brown soils, less fertile than the black soil. Agriculture, livestock raising, particularly by the native tribes, and mining are the chief industries there.

POPULATION

In 1915 the population of Siberia was estimated at 12,800,000, 2.4 persons per square mile. It is considered (a) that only about one-quarter of Siberian area, covering about 1,300,000 square miles, excluding the tundra in the north and the mountains in the south, is suitable for human activity, and (b) that about 90 per cent of the population is segregated in this habitable area. This works out as 10 persons per square mile, which is more than the density in the states of Montana, Idaho, Utah, Oregon, the Dakotas, or Colorado. In the agricultural belt of western Siberia the density prior to the World War was estimated as high as 20 to 25 persons to the square mile, or approximately the same as in Kansas, California, or Maine.

The population consists of aboriginal tribes, numbering according to the census of 1910 about 2,200,000 people, and of Russian colonists. These tribes live a primitive life, still being in the "collective" stage and, therefore, count but little economically. Among them the Chuckchee, Koriaki, and Kamchadaly, living in the extreme northeast of Siberia, are hunters, fishermen, and reindeer breeders. So are the Finns and the Samoyeds, who inhabit the northern regions of western Siberia. The Tungusy, who are scattered over all eastern Siberia, are hunters. The Buriaty, occupying regions around Lake Baikal, in part raise livestock and in part crops.

FIGURE 3.—A typical Siberian home in Chita, primitive and substantial as the log cabins of the early American settlers.

The Yakuty, in the Lena Basin, are livestock breeders; so are the Tartars, who inhabit western Siberia, and the Kirghizy, who roam with large herds over the steppes.

The Russians invaded Siberia in the sixteenth century. At first the movement of Russians into Siberia was slow. But from 1897, when the first census was taken, to 1914, the number of Russian colonists mounted to over five million persons, or more than the entire Russian population settled there for the preceding three centuries. This inflow of Russian farmers was still further accelerated by the construction of the Trans-Siberian Railroad, and was particularly large just before the beginning of the World War. The Russians, being practically all farmers, settled in the black soil zone, along the railways and in few river valleys.

About nine-tenths of the population live in the rural districts. The farmers usually live in villages, consisting of log-huts adjacent to each other and strung out on both sides of its single street. The urban population began to increase only recently. Siberian towns usually consist of wooden dwellings, generally one story high. Public buildings, however, are often of brick and of fine architecture. In 1904 only few towns had public utilities of any kind. Waterworks, sewerage, and lighting systems, mostly kerosene, were of a primitive character, and the streets were unpaved. In the years just preceding the World

War these cities made notable improvements in developing their public works and educational facilities. The present population of Siberia is estimated at about 15,000,000. The majority of the population are Christians; the Tartars and Kirghizy are mostly Mohammedans; among other tribes there are also idolators. Education is even less developed than in European Russia. In 1912 the percentage of literates was not higher than 16 per cent.

NATURAL RESOURCES

Agriculture and industries based on or related to agriculture are the most important in Siberia at present and will remain so for a considerable time to come. It will take much capital not yet available, and a long period of time to develop the country industrially to a point when factories, mills, and shops rise above agriculture in some parts of the country.

AGRICULTURE

The area suitable for agriculture is limited by unfavorable geographical location and climatic conditions. The entire north and northeast are frozen tundras; the southeast is too wet; the southwest is too dry; many areas in western Siberia are too moist and swampy, while others in eastern Siberia are too high, rocky and cold for agriculture, which is confined largely to the black-soil belt, a zone with fertile soil across which the Trans-Siberian Railway extends. Comparatively small acreage is found north and south of this "chernoziom" belt.

Western Siberia is more favorable for agriculture than eastern Siberia, largely on account of the difference in relief and altitude. In western Siberia there are vast plains of low altitude, particularly between 53° to 58° north latitude, where there are large expanses of fertile soil. In eastern Siberia there are few plains, most of the lowlands being only narrow valleys. The slopes of the mountains are steep, and the summer temperatures are low, owing to high altitudes. It may be noted, however, that between 59° and 63° north latitude, along the middle course of the Lena River and its tributaries, the Olekma and the Aldan, the climatic conditions are more favorable than in western Siberia under the same latitudes. In western Siberia the influence of the cold from the Kara Sea on the north, and of the hot steppes from the south bring sharp fluctuations in temperature. The large number of marshes aggravates the danger of night frosts at the beginning and at the end of the summer. In the region along its middle course the Aldan River marshes are fewer, and hot steppes are absent. Here temperature fluctuations are less severe. In general, it may be said the climate of the agricultural zone is not dissimilar to that of Minnesota and the Dakotas. With hardly lower temperatures, it is drier, with many more hours of sunshine per annum, and less severe winters.

ACREAGE, CROPS, AND YIELDS

Siberia is the land of peasants. The census taken in 1917 just prior to the revolution recorded nearly 2,000,000 farmsteads, of which 81 per cent belonged to peasants, 15 per cent to natives, and 4 per cent to Cossacks. The total acreage under crops was 27,400,000 acres, comprising about half of the land which at one time or another had been in crops or used for hay meadows. Of the rest, about one-third had been left untilled for many years, in order to recover its fertility, while about one-sixth in accordance with the general system of rotation of crops was fallow land. On the average, each farm had 27.5 acres of improved land, of which 14 acres were cropped and 13.5 acres were fallow.

The latest normal five-year period for which reliable information is available is that of 1911 to 1915, and the returns for that period have been used in the following discussion.

At that time the area under all crops was about 21,000,000 acres. Grains occupied 96 per cent of all cultivated land. Spring wheat occupied 48 per

cent of the cultivated land; oats, 28 per cent; rye, 14 per cent. The balance was distributed as follows: barley, 4 per cent; potatoes, 2 per cent; flax, 1 per cent; hemp, 1 per cent, and miscellaneous crops, 2 per cent.

Surplus grain from the Western Siberian plains has been shipped west to European Russia and foreign markets. Therefore the freight costs have influenced most decidedly the development of Siberian agriculture. The acreage under grain is along the Trans-Siberian Railroad and a few river valleys over which the wheat might be brought to market. Transportation costs increase the greater

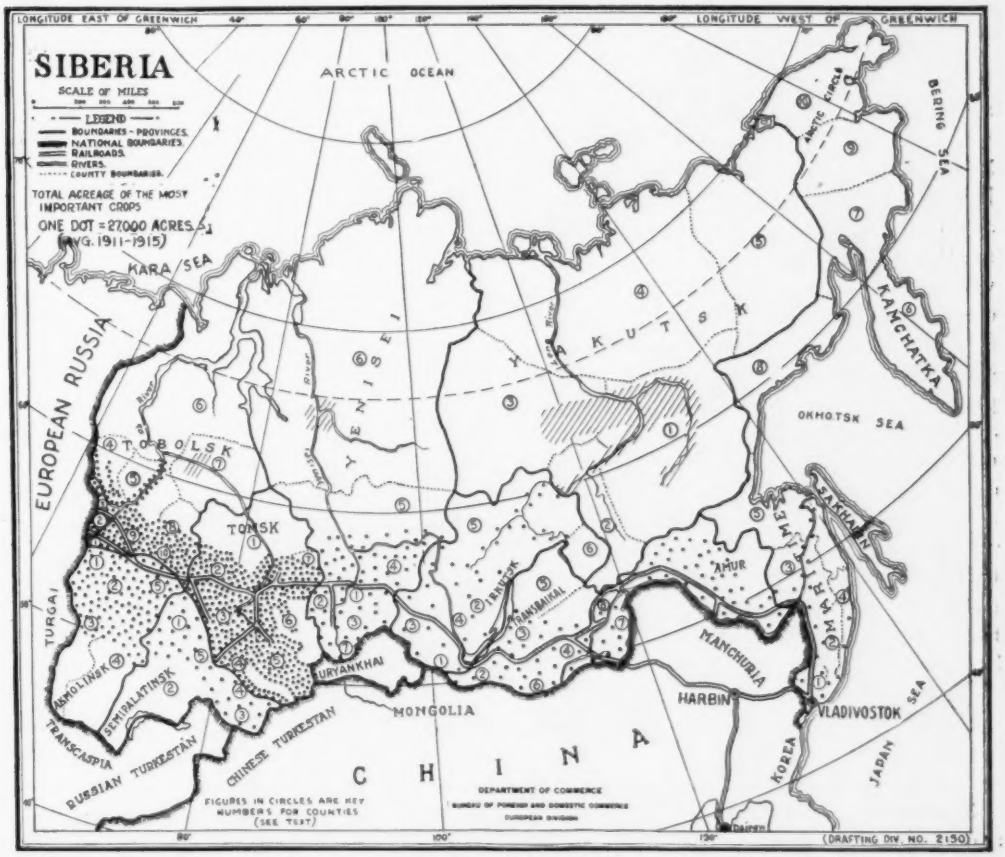

FIGURE 4.—The distribution of crop lands in Siberia indicates how relatively little of its great expanse is devoted to the growing of foods and textiles. Of the unoccupied area practically all the inhospitable tundra in the north and much of the taiga farther south will never be amenable to agricultural development. The numbers which appear on the map refer to the various divisions of Siberia, showing the following counties in each province:

Tobolsk Province:
1. Kurgan.
2. Yalutorovsk.
3. Tiumen.
4. Turinsk.
5. Tobolsk.
6. Berezov.
7. Surgut.
8. Tarsk.
9. Ishim.
10. Tiukalinsk.

Tomsk Province:
1. Tomsk.
2. Kainsk.
3. Barnaul.
4. Zmeinogorsk.
5. Biysk.
6. Kuznetzk.
7. Mariinsk.

Akmolinsk Territory:
1. Petropavlovsk.
2. Kokchetavsk.
3. Atbassar.
4. Akmolinsk.
5. Omsk.

Semipalatinsk Territory:
1. Pavlodar.
2. Karkaralinsk.
3. Zaisan.
4. Ust-Kamenogorsk.
5. Semipalatinsk.

Yenisei Province:
1. Krasnoyarsk.
2. Achinsk.
3. Minusinsk.
4. Kansk
5. Yeniseisk.
6. Turukhansk.
7. Usinsk.

Irkutsk Province:
1. Irkutsk.
2. Verkholensk.
3. Nizhne-Udinsk.
4. Balagansk.
5. Kirensk.
6. Vitim-Olekma.

Transbaikal Territory:
1. Troitzkosavsk.
2. Selenginsk.
3. Verkhne-Udinsk.
4. Chitinsk.
5. Barguzinsk.
6. Akshinsk.
7. Nerchinsk-Zavodsk.
8. Nerchinsk.

Maritime Territory:
1. Nikolsk-Ussuriisk.
2. Iman.
3. Khabarovsk.
4. Olga.
5. Udsk.
6. Petropavlovsk.
7. Gizhiginsk.
8. Okhotsk.
9. Anadyrsk.
10. Chukotsk.

Yakutsk Territory:
1. Yakutsk.
2. Olekminsk.
3. Viliusk.
4. Verkhoyansk.
5. Kolymsk.

the distance east of the Urals, consequently the acreage diminishes.

Among other plants cultivated in Siberia are buckwheat, millet, peas, beans, sugar beet, which can be grown quite successfully on a considerable area, and kafir corn, and rice in Maritime Territory. A wild plant, kendyr, produces strong and durable fiber.

The yields in Siberia are considerably lower than in the United States or in Canada. Another feature of Siberian agriculture is the fluctuation of yields which are more pronounced in western Siberia because it is open to the cold blasts from the Arctic Ocean on the north and to the hot winds from the dry steppes in the south, than in eastern Siberia where there is not so wide a range of climatic conditions and the yields are fairly stable. These low yields and their fluctuations may be attributed in part to primitive methods, although the use of agricultural implements in Siberia is much greater than in European Russia, owing to the short growing and harvesting season, scarcity of labor, and larger size of farms. During the period of 1910 to 1914 the annual purchases of agricultural implements averaged $10,000,000, the bulk coming from the United States.

POSSIBLE EXPANSION OF SIBERIAN AGRICULTURE AND OF GRAIN EXPORTS

Some persons believe that Siberia can accommodate hundreds of millions of new farmers who would flood the world markets with grains, while others regard Siberia as a frozen wasteland and dismiss it altogether as an agricultural producer. Neither is true. Since the construction of the Trans-Siberian railway the acreage under grains showed a remarkable growth. A comparison of the average acreage under grains in 1901 to 1910 with that of 1911 to 1915 shows a material increase, 61 per cent in acreage and 43 per cent in production. The average acreage in the latter period reached 21,000,000 acres, that is, about one-seventh of the land at the disposal of the rural population. The largest gains were made in western Siberia, particularly in the steppes.

It is generally considered that only areas south of latitude 58° north are suitable for agriculture. It is estimated that in addition to the land already at the disposal of the population there may be about 200,000,000 acres suitable for crop raising. This land may accommodate 4,000,000 families or about 20,000,000 people. If it be assumed that all cultivable land is tilled and that crops will retain the same relation to each other as before, then the acreage under spring wheat may reach 150,000,000 acres, or about three times as much as in the United States in 1924; and the acreage under oats, 75,000,000 acres, or nearly twice as much as in the United States in the same year.

The surplus wheat which might be available for export after allowing for local consumption of 35,000,000 persons, in that case would be over 1,000,000,000 bushels of wheat. If American agricultural methods were to be applied there and similar yields secured, that surplus may reach 2,000,000,000 bushels. The production of oats might reach 2,500,000,000 bushels against 1,500,000,000 bushels produced in the United States in 1924. These surpluses may be even larger as new methods of agriculture are introduced which will extend the present limits of the agricultural zone to the north and to the south.

The Russians have succeeded in developing strains of soft spring wheat which stand extreme drought and produce about 13 bushels per acre, at times when all other crops are a complete failure. This achievement allows extension of grain cultivation farther south into the steppes and arid regions. In eastern Siberia several strains of quick maturing and cold resisting spring wheat and oats have been evolved, thus permitting expansion of the agricultural zone farther north. These facts call attention to the potentialities of large

areas of lands which heretofore have been considered outside the agricultural zone.

Feasibility of large grain production, however, is only one of many factors in the situation. Economic conditions in Siberia and other countries will influence in large measure the expansion of acreage and exports of Siberian grain. At present the heavy cost of shipping Siberian grains to world markets has practically prohibited such movement. Until the problem of low-cost transportation and many others of prime importance are solved, exports of Siberian grains on a large scale are a potentiality rather than a reality.

LIVESTOCK

The Kirghiz Steppes in the southern portion of Siberia, those in Minusinsk region of the Yenisei Province, and in Transbaikal Territory support a considerable number of livestock. In 1917 in all Siberia there were 11,400,000 head of cattle, 7,800,000 horses, 14,700,000 sheep, 3,400,000 hogs, and about 1,000,000 goats. The significance of these figures will become clearer if the number of domestic animals per capita in Siberia is compared with that in the United States. These returns show that Siberia had three times as many cows and goats, and one and one-half as many cattle as were in the United States according to the 1920 Census. Of hogs Siberia had per capita only half as many as the United States. This may be attributed to the fact that the native tribes ignore this branch of animal industry and hogs are raised by Russians only. Raising of hogs in Siberia, however, may be very profitable, because, owing to Siberian climate the bristles are of excellent quality, and bacon is palatable, and there is an abundance of feed for the hogs, such as skimmed milk from numerous creameries. Horses and cattle are of local breeds. The animals receive little care, being left to shift for themselves even in winter, so are sturdy, but small.

FIGURE 5.—Siberian ponies assembled for sale at one of the markets of Chita. They are a wiry, hardy breed, indispensable to the farmer and the traveler.

DAIRYING AND POULTRY RAISING

Dairying started in the nineties of the last century and quickly assumed large importance, since dairy products better than grains can stand the heavy transportation charges. Exports of butter alone rose from 14,000 pounds in 1894 to 165,000,000 pounds in 1912. Another interesting feature of this industry was that it was managed entirely by the peasants themselves, united into coöperative societies. These societies collected the milk from individual farmers at their creameries, marketed the butter through their own organizations abroad, and purchased and distributed among their members the necessary supplies.

For chickens, geese, and ducks, conditions in Siberia are favorable. Eggs, meat, and feathers already are being exported. Agriculture has been little developed, and is practically all confined to Tomsk Province in western Siberia.

Siberian meadows, steppes, and pastures have sweet and nutritious grass and allow plenty of space for grazing and foraging. The long and cold winters, however, during which stock must be fed

and sheltered, are a handicap to stock raising.

FISHERIES

Siberian waters, ocean, rivers, and lakes, abound in fish. In the north and in the northeast where fish takes the place of bread for the natives, fishing is of prime importance. Siberian fish are of fine flavor and texture. When modern methods of packing are used the quality of the Siberian fish products is said to equal the best of any country. Their reputation, however, suffered from primitive and careless methods of preparation employed by local fishermen. Destructive methods of fishing, totally disregarding the future supply, have depleted certain fishing grounds and have led to a decline in catch.

The most important fishing region is the Russian Far East, having a coast line of 12,000 miles along the shores of the Japan, Okhotsk, and Bering Seas. The total annual catch there averaged 113,000 long tons in 1909 to 1913; 119,000, in 1914 to 1918; and 128,000, in 1919 to 1922. Salmon constituted about 90 per cent of the entire catch; other species of importance are herring, cod, and crab. Russian fisherman have lacked capital, credit, and transportation facilities, have been short of salt and of labor; therefore the fishing industry in these waters is in the hands of the Japanese, who enjoy the advantages of cheap and abundant labor, good shipping facilities and low freight rates. The canning industry is very little developed. These plants are mostly in the Kamchatka peninsula, confining their activity to the canning of salmon. About 90 per cent of the canning plants are controlled by the Japanese. In 1921 to 1923 the pack in the Russian Far Eastern waters averaged over 700,000 cases, each containing 48 one-pound cans.

The most important salmon fishing grounds are the waters of the Kamchatka peninsula. The catch of the Nikolayevsk-on-Amur district averaged only 10 per cent of the total catch in 1919 to 1922. Herring are numerous in all the waters of the Russian Far East. The catch, however, has been small, though gradually increasing from an average of 4,000 long tons in 1909–1913 to 10,000 long tons in 1919–1922. Cod are so abundant in those waters that sometimes cod shoals are said to be over a mile long and several feet deep. Lobsters and crabs of extraordinary size and of high quality are caught along the Siberian coast of the Japan and Okhotsk Seas. Other fishing regions are the Lena-Kolyma, Yenisei, and Ob Rivers, and Lake Baikal.

FURS

Siberia is one of the world's most important sources of furs. Trapping is of considerable economic importance in the tundra and in the taiga, in some localities being the chief means of livelihood. Extensive forests, almost inaccessible mountains, sparse population, are favorable for the propagation of fur-bearing animals. Their numbers, however, are dwindling, owing to overhunting. Enforcement of hunting laws over such a vast territory inhabited by primitive people is very difficult. The most important fur-bearing animals are squirrels, abounding wherever spruce and cedar trees grow. Sables, formerly very common in the forests from the Urals to the Bering Sea, but now found only in unfrequented sections; fox, which is found in forests and in steppes, and along the Arctic coast; hare, ermine, bear, marten, and others. In 1924 the United States imported over $80,000,000 worth of undressed furs, of which nearly $7,000,000 worth was credited directly to Russia in Europe and in Asia. Since the bulk of Siberian fur comes through European Russia and through other countries, the share of Siberian furs is undoubtedly much larger than it appears from the above-mentioned figures.

FOREST RESOURCES

Siberian forests, usually known as taiga, or virgin forests, extend across the

entire width of Siberia from the Urals to the Pacific. These forests are not in unbroken tracts and, in western Siberia, usually follow the watersheds where the soil is not so wet. The best stands are found on southern slopes protected from the Arctic winds. The mountainous character of eastern and central Siberia is reflected in the location and composition of the forests, which are distributed in belts, the trees becoming smaller at the higher altitudes and disappearing altogether as the timber line is reached. The most important species of trees in the taiga are the conifers, consisting of pine, larch, Siberian true fir, spruce, and cedar; in eastern Siberia larch is the predominating species. Deciduous trees are represented by birch and aspen in western Siberia, to which are added the velvet tree, ash, maple, and elm in the Russian Far East. In the extreme southeast, where the climate is milder and precipitation most abundant, the taiga changes its appearance and resembles the forests of Korea and of part of Japan. In western Siberia the taiga in the forest-steppe zone gives place to separate forests consisting largely of birch, aspen, and also of alder and ash. In general, it is estimated that in Siberia conifers occupy from two-thirds to three-fourths of the forest area and deciduous trees from one-fourth to one-third, one-fourth of the forests being spruce and fir, and about one-half pine, cedar, and larch.

FIGURE 6.—A supply of wood for use on one of the river steamers of Siberia. Abundance of timber, and inadequate transportation to bring coals from the mines, combine to make wood the cheaper, more readily available fuel.

FOREST AREA

No exact data exist as to the total area of forests in Siberia. In 1914 the state forests occupied nearly 600,000,000 acres; crown forests covered about 54,000,000 acres; the Cossacks possessed about 27,000,000 acres, and in Yakutsk Territory were some 120,000,000 acres. Thus the total area under forests was roughly about 800,000,000 acres. Other authorities estimate this area at 1,300,000,000 to 1,500,000,000 acres; this estimate probably includes immense areas of burned over lands, swamps, bogs, and barren wastes. Still others estimate the Siberian forest to cover as much as 2,700,000,000 acres, probably based upon an assumption that forest growth extends much farther to the north and also higher up the slopes of mountains than is commonly accepted to be the case. Only in regard to an area of 120,000,000 acres of

state forests which have been investigated are there more or less definite data. In 1914, of the total area under state forests, only 46 per cent was productive, being considerably less than in European Russia; this may be explained by the severe climate in the north, and by the existence of vast marshes and vast forest lands denuded by fires.

EXPLOITATION OF FORESTS

In sparsely populated places wood has had no market and the forests have been used by the population to gather cedar nuts and berries. In order to insure an abundance of berries the natives, every eight to ten years, burn the underbrush in the forests, incidentally destroying the young growth. These fires devastate vast areas covered by valuable stands of conifers, which are replaced by birch and aspen of inferior quality, or, after repeated fires become treeless wastes. Very little wood offered for sale has found buyers. In 1914 the State forests sold less than 200,000,000 cubic feet, valued at $1,350,000. The wood working industries and those using wood as basic material have been very little developed. In 1913 their entire production was estimated to be about $2,000,000. On the basis of an estimated population of 15,000,000 its consumption of wood might be as much as 600,000,000 cubic feet annually. Even when population increases and industries develop, creating a larger demand for wood, it is estimated that local consumption still may utilize but a small fraction of one per cent of Siberian standing forests, making the balance available for export.

TIMBER EXPORTS

Before the World War only limited quantities of Siberian wood found their way abroad. From western Siberia small shipments were exported via Petrograd and Archangel, but this long rail haul was expensive and restricted such exports. Traffic down the Ob and the Yenisei Rivers and then through the Kara Sea, though feasible, has not been developed for regular trade. The Russian Far East, having a better outlet to foreign markets, started to export timber to neighboring countries. Siberian wood might be exported to the countries bordering on the Pacific Ocean, China, Japan, and Australia, as well as to South Africa and Europe. China, having practically no large forests except in Maachuria, imports a considerable quantity of wood. Japan is an importer of Siberian wood and may become a still greater one. The forest area of Japan is not large and at the same time its population is increasing. Australia possesses forests of hardwood but not of soft wood for woodworking industries. Imports of softwood into Australia are large and Siberia may look to that country for a sizable market.

An interesting development in the world timber trade may be the appearance on these markets of Siberian cedar and larch. Cedar has been exported to Japan and other countries and has won favor in many lines. Larch attains very large dimensions in Siberia. Its wood is heavy, strong, and durable, being suitable for farm fences, for houses, railroad trestles, telegraph poles, paving blocks, and mine props. Larch is particularly well suited for under-water and underground construction, and for shipbuilding as it stands up well under such exacting demands. There are in Siberia buildings three centuries old where the larch timbers are still in good condition. Larch forests are estimated to cover 145,000,000 acres in eastern Siberia alone. Cedar is also very common in Siberia, being estimated to cover 4,000,000 acres in the Sayan region of Yenisei Province alone, while east of Lake Baikal about 6,000,000 acres have a growth of cedar.

These forests are a potential timber resource of great magnitude. One can imagine what effect the introduction of these species by modern marketing methods might have on the timber market, where they may come in direct competition with other commonly used species, even displacing some well estab-

lished types of timber in many lines owing to their superior technical qualities.

The economic potentialities of the forest wealth of Siberia are exceeded only by those of its agricultural and mineral resources. The practically untouched forests may one day become a field of activity not only for logging and lumbering, but also for industries using wood as raw material, such as pulpwood, cellulose, paper; and wood distillation. The exploitation of these forests on a large scale for export purposes, however, can materialize only when the cost of felling and moving the logs to the rivers is lowered by the application of up-to-date methods of lumbering, and by the substitution of modern machinery for manual labor and animal power. More adequate transportation facilities with lower freight charges must also be provided. Siberia can share in the world timber and lumber trade only when conditions there favor the building up of many organizations and agencies indispensable for commercial activity and for the investment of capital, particularly of foreign capital, as local capital is nonexistent. Introduction of capital and development of commercial agencies come slowly, therefore the possibility of Siberian large scale wood exports is more in the future than in the present. Siberia's rôle as a potential exporter of wood will expand, measure for measure, as these needful facilities for economic development materialize. The regions where conditions are favorable for starting exports, as experience has shown, are the Russian Far East, and the Ob and Yenisei Basins, whence small shipments of wood have been made to various countries. The Russian Far East, has an outlet for its products through the Amur River which flows into the Pacific Ocean and by way of the Trans-Siberian railroad which, connecting with Chinese and Japanese railways, is near consuming markets, important factors that will favor earlier development in this region than elsewhere. The Ob-Yenisei region with its forests of high-quality timber, may attain some importance only when the Kara Sea route is utilized, thus obviating the prohibitive railroad charges to world markets.

METALS AND MINERALS

The mineral wealth of Siberia is second only to its agricultural resources. These resources are only partially known, because Siberia has been surveyed geologically in but few localities—systematic work being carried on mostly along the Trans-Siberian railway and in the gold-bearing regions. Yet even incomplete exploration revealed resources that may justify the expectation that in time to come the mining industry will occupy an important place in the economic development of Siberia.

Before the World War mining in Siberia was little developed, owing to insufficient knowledge of its mineral resources and still more to unfavorable economic conditions such as limited transportation facilities, shortage of labor, antiquated methods of production, small local demand, and insufficient capital and credit.

The Siberian industry will expand only with the investment of foreign capital. Advent of this capital into mining, industrial, and road building activities will accelerate the rate of immigration, directly attracting industrial workmen, and indirectly appealing to farmers, who will benefit from the improved economic conditions. There will be increased buying power in local markets; better possibilities for export of farmers' produce, and lower prices for the goods needed by the peasants themselves. This increased population will also become a source of a large labor supply.

PRINCIPAL ORE FIELDS

The geologic structure of Siberia, lowlands and plains in the west and mountains and tablelands in the east, to whose formation both volcanic and other tectonic forces have contributed, is reflected in the distribution of mineral resources, in which Eastern Siberia is much richer than Western Siberia. Broadly there

are four principal mineral fields; the Altai region and the Kirghiz Steppes in the west, and Nerchinsk region, Transbaikal Territory and Russian Far East in the East. The last-named is the more attractive commercially because it is more easily accessible, has better transportation facilities, plenty of coal, and is nearer to foreign markets.

A Review of Siberian Mineral Resources

Iron ore deposits have been little worked in Siberia. In 1913 there were mined only 3,300 tons of iron ore. The annual amount of pig iron produced (1909–1911) was about 1,600 tons, although there are numerous deposits containing considerable tonnage of high-grade iron ore. These deposits are sufficient to take care of the needs of the present population and its immediate increase. The *Telbes* deposit in Tomsk Province, located in the Kuznetzk Coal basin, is estimated to contain 26,000,000 tons of iron ore. It is connected by a branch line with the Trans-Siberian Railroad. The *Minusinsk* iron district in Yenisei province is traversed by a branch line of the Trans-Siberian Railroad, and is near coal fields. The *Olga* iron district is in the Maritime Territory on the coast of the Japan Sea, where coal can be had from the mainland and from the Sakhalin Island lying directly opposite. There are partly worked iron ore deposits in Irkutsk Province where the Nikolayevsk Iron Works, have access to the Cheremkhovskoye coal fields, and also in Transbaikal and Amur Territories. When Siberia is more adequately surveyed discovery of new iron ore deposits is not unlikely.

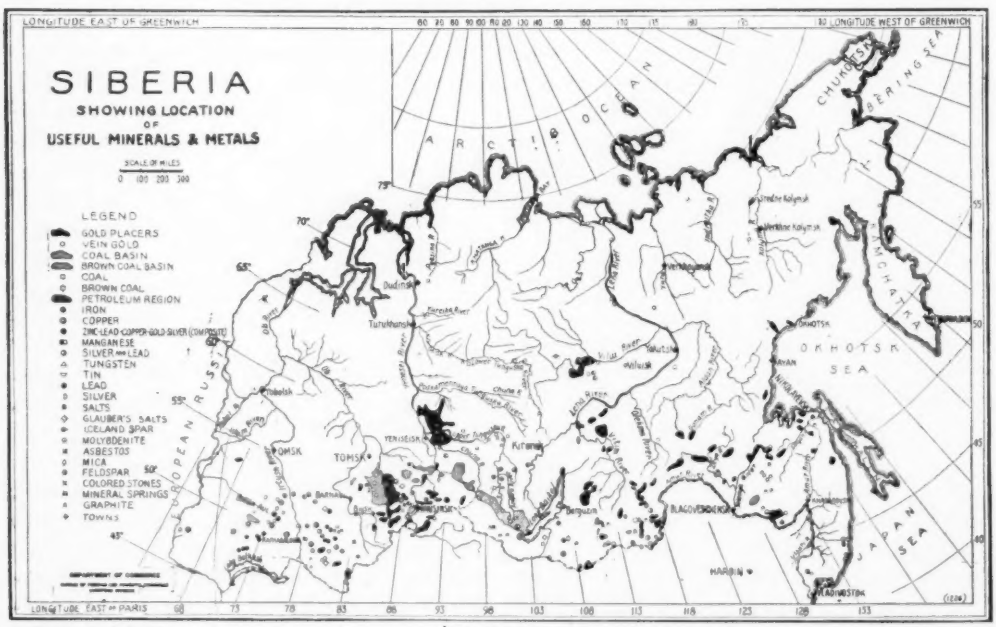

FIGURE 7.—The known mineral resources of Siberia are formidably impressive; the deposits yet awaiting discovery may well be of even greater extent, value, and significance, since vast areas of the land are practically unexplored. The far interior location, the northward flowing rivers, the unfavorable climate, the rugged plateaus, and the impenetrable forests, help to retard the development of adequate transportation facilities.

ALLOY METALS

Maganese ores are found in the principal iron ore districts. The best known wolfram or tungsten deposits are those in the Onon-Borzia locality, in Nerchinsk district. In Transbaikal Territory are

also reported molybdenum, chromium, nickel, and cobalt ore deposits.

COPPER

The most important copper deposits are in the Kirghiz Steppes, in the Altai region, and in the southern part of Yenisei Province, although copper, is also found in other places. In the Kirghiz Steppes the copper mines are near coal beds. The largest plant in this region, the Spasski Copper Works smelted from 3,000,000 to 10,000,000 pounds annually from 1909 to 1913. The Altai region is credited with 9,000,000 tons of copper ore, estimated to contain 150,000 tons of metallic copper. The copper deposits in Achinsk and Minusinsk counties, Yenisei Province are fairly large. Terezia Mines have an estimated tonnage of 1,200,000 tons of copper ore and the Julia Mines at 3,000,000 tons. Recently numerous copper ore deposits have been discovered in the Uriankhai region, just south of Yenisei Province.

OTHER NONFERROUS METALS

The most important tin deposits are found in the basin of Onon River in Transbaikal Territory, as well as in the Kirghiz Steppes, Yenisei and Tomsk provinces, and in the Maritime Territory. Antimony and arsenic are commonly encountered in the silver-lead deposits in Transbaikal Territory. Bismuth is found in Amur Territory. Ores from which aluminum and mercury are recovered are found in Akmolinsk Territory, aluminum in Yenisei and Irkutsk Provinces, and mercury in Transbaikal Territory, and some other places.

ZINC, LEAD, AND SILVER

The best-known zinc-lead-silver deposits are in the Altai region, in the Nerchinsk district of Transbaikal Territory, and along the southeastern coast of the Maritime Territory, while lead-silver deposits occur in the Kirghiz Steppes. In the Altai region and Nerchinsk district, only silver has been mined because of its higher value. The less valuable lead has been produced as a by-product, while zinc has been altogether neglected. In the Altai region five groups of these deposits during a century and a half, ending with the World War, produced over 7,000,000 short tons of zinc-lead-silver ore. The probable tonnage of these deposits has been estimated at nearly 10,000,000 short tons, with a metallic content of 1,200,000 short tons of zinc, 550,000 tons of lead, 1,700 tons of silver, 170,000 tons of copper, and 240,000 troy pounds of gold. In the Tetiukhe district, in the Maritime Territory, the tonnage of these ores in sight is estimated at 1,000,000 tons, containing from 15 to 20 per cent of zinc, 10 to 15 per cent of lead, and considerable quantities of silver. Nerchinsk district during the eighteenth and nineteenth centuries produced over 50,000 short tons of lead and 540 short tons of silver.

GOLD

The Siberian gold fields are estimated to run into many hundred thousand square miles and are considered by some authorities to comprise the largest area of goldbearing ore still awaiting development anywhere in the world. Only an insignificant fraction of this area has been exploited. During the decade 1904 to 1913 less than 4,000,000 acres bearing gold were worked annually. To date the total value of Siberian gold production is placed at more than one billion dollars. During the years from 1910 to 1914 gold production there averaged around 1,500,000 troy ounces annually. In effect there has been hardly any gold industry worthy of the name. It has been rather gold prospecting, and that in a casual way. Only those deposits have been mined from which gold could be recovered with the least employment of capital and labor, the bulk of Siberian gold coming from placers. The economic importance of the gold industry, however, is very great. It has been the largest single industry, employing the

greatest number of workmen—57,000 in 1913, capitalized at upward of $100,000,000, with a production of about $30,000,000 annually. In Western Siberia there are four gold mining districts, North Steppes, South Steppes, Altai, and Tomsk. Development of the gold industry there depends, among other things on working lode mines. The largest part of Eastern Siberia is as yet unsurveyed, so far as gold deposits are concerned. Chance discoveries of gold deposits such as the Aldan gold fields beyond the exploited fields, tend to show that additional goldbearing areas may yet be opened up in that part of Siberia. In Yenisei Province there are two gold fields, the North Yenisei and the South Yenisei, formerly famed for their richness in gold. The largest gold fields are within the Olekma-Vitim region, in the Lena River Basin, having as its center the Bodaibo River. This region is remote from all commercial centers of Siberia. Numerous gold deposits are in the western part of Transbaikal Territory, in the basins of Barguzin, and Dzhida Rivers; and in the east, in the Nerchinsk district. In Amur Territory rich gold fields are known in the basins of the Zeya River and its tributaries the Guilui, Selemzha, and some others, and also in the basins of the Bureya, and Amgun Rivers, all in the Amur basin. Rich and extensive gold deposits are reported as to exist on the coast of the Okhotsk Sea.

RARE METALS

Platinum, iridium, and osmium are found in the Viliui River, in Yakutsk Territory, in the Uriankhai region and elsewhere. In 1923 platinum and palladium bearing rocks were discovered near the mouth of the Yenisei River. This is an important find, because these trap rocks are known to extend over large areas. Strontium is found in Yakutsk Territory; lithium in Transbaikal Territory; while radioactive substances such as monazite are found in Transbaikal and Altai Territories.

COAL

Siberia's coal resources are estimated at 400,000,000,000 metric tons, equivalent to one-fourth of all the coal resources of Asia or one-half of those of Europe. This estimate, however, does not take into consideration the vast Tungusk coal basin. The most important coal basins from the standpoint of location and transportation facilities are the Kuznetzk Basin in Tomsk Province, with an estimated tonnage of over 250,000,000,000 metric tons; Irkutsk Basin, 150,000,000,000 metric tons; Minusinsk, 870,000,000 metric tons; Kirghiz Steppes, 1,100,000,000 metric tons; Sakhalin Island, 2,000,000,000 metric tons; and the Maritime Territory, 270,000,000 metric tons. Large coal beds, mostly of brown coal, are located in Amur and Transbaikal Territories with an estimated tonnage of 1,000,000,000 tons.

Kuznetzk basin covers an area of nearly 9,000 square miles. Its coals are of many kinds and of high quality. Its coal production was 1,260,000 tons in 1917. The Irkutsk Basin covers an area of over 17,000 square miles, stretching along the Trans-Siberian Railroad for nearly 300 miles. Its coals are mostly bituminous coking coals, and in 1917 its production was about 1,240,000 tons. These two areas have supplied nearly all the coal produced in Siberia, other fields producing small quantities only. The tonnage of the Khakhareiski coal deposit, located near the Nikolayevsk Iron Works, prospected in 1920, is estimated at 260,000,000 tons. The Sakhalin Island coal beds are said to be the best of all coal deposits on the Pacific Ocean. Their location near the coast and the surrounding topography permit their development without large outlay of capital. The Kirghiz Steppes coal beds yield coal of relatively inferior quality. Production there was about 100,000 tons in 1917. In the Maritime Territory coal beds are found in the southern part, and the production of coal there in 1917

amounted to about 600,000 tons. Of great interest is the Tungusk coal basin in the Yenisei Province, covering an area of nearly 400,000 square miles, but very little data exist upon which it would be possible to estimate the tonnage.

Waterpower

Preliminary surveys of the waterpower of Siberia place the total at 28,000,000 h.p. at power sites; of which 8,000,000 h.p. are in the Lena-Baikal region. Considering that that region is rich in forests and in coal, it looks as though, at some future time, this region, with its vast power resources may become a center of industrial activity for manufacturing the raw materials brought there, from both western and eastern Siberia.

PETROLEUM

Petroleum is found along the eastern coast of Sakhalin Island in a strip from one-quarter mile to two miles wide and about 250 miles long, at a distance of from two to thirteen miles from the sea. In the Kamchatka Peninsula oil is found about 30 miles inland from its eastern shore, and also is reported in several other places there. Oil is reported in Yakutsk Territory, and on the southeastern shore of Lake Baikal; in the last-named locality mineral wax is washed ashore and has also been located in the estuary of the Selenga River, emptying into Lake Baikal.

An estimate of 1,300,000,000 to 3,500,000,000 barrels of oil on the Pacific Coast eventually may not be found excessive. There is a possibility of large oil supplies from the boghead (a dark brown variety of cannel coal valuable as a source of paraffin oils and gas) coals in the Irkutsk coal basin. The tonnage of these boghead coals, according to preliminary estimates, is about 2,000,000,000 tons. Laboratory experiments have shown that these coals produce from 38 per cent to 49 per cent of tar; from the latter there have been recovered lighting, lubricating, paraffin, and other kinds of oil. Recent newspaper reports emanating from Moscow tell of rich oil deposits along the banks of the Yenisei River about 200 miles from its mouth.

GRAPHITE

The most important and extensive graphite deposits are in the basins of Lower Tunguska, Bakhta, and Kureika Rivers—all right tributaries of the lower course of the Yenisei River. From a commercial standpoint, of particular importance are the deposits along the Kureika River, the mouth of which can be reached by ocean-going vessels. Graphite there can be mined by open cuts. The graphite is of amorphous type, exceptional for its purity. The well-known Aliberov graphite deposits in Irkutsk Province produce graphite which is good not only for pencils, but also for crucibles.

OTHER MINERALS

Spar

Most of the feldspar used in Russia has been imported, although there are deposits in Yenisei, Irkutsk, and Transbaikal Territories. Fluorspar is known in both western and eastern Siberia, and of particular importance is the Boguchan deposit in Amur Territory. Iceland spar exists in Yakutsk Territory and on the Chukotsk peninsula. Selenium and tellurium are found in the Altai region and in Transbaikal Territory. Native sulphur is known in the Kirghiz Steppes, Tomsk Province, and in Transbaikal and the Maritime Territories. Pyrites have been mined in Tomsk Province. Mica has been worked in Yenisei Province, where the Kansk deposits supplied a steadily growing amount of mica—155,000 pounds in 1917. The largest and richest deposits of high-quality mica, the Mamsk deposits, are in Irkutsk Province, located in a region remote from transportation. Asbestos of remarkable purity has been found in Minusinsk County, Yenisei Province, although known to exist in a number of places. The soda deposits of Lake

Doroninskoye in Transbaikal Territory are estimated at 400,000 tons. The largest deposists of Glauber's salt are in Tomsk Province, where some of the lakes are said to contain millions of tons of this mineral, though extensive deposits are also reported in Yenisei and Irkutsk Provinces and in Transbaikal Territory. The salt industry has been little developed. In western Siberia salt is produced from salt lakes. The largest production, 130,000 tons, was reached in 1910 and 1911. The richest salt lakes are located in a chain stretching between the towns of Semipalatinsk and Akmolinsk. Salt lakes are also located in Tobolsk, Tomsk, and Yenisei Provinces, and in Transbaikal Territory. In Yakutsk Territory are large deposits of rock salt. In Irkutsk province salt is produced from boreholes. In eastern Siberia salt production has been small, about 15,000 tons only. In Amur and Maritime Territories no reliable salt deposits are known so far, and the salt necessary for the important fishing industry there is imported.

Mineral earth and pigments are known all over Siberia. Fuller's earth and infusorial earth exist in Transbaikal Territory and are reported in Yenisei Province and the Maritime Territory. Building and ceramic materials such as sandstone, slate, quartz, kaolin, fire clay, gypsum, limestone, and sand are found in nearly all administrative divisions of Siberia. Marble of different colors is common in the Altai region, Yenisei and Irkutsk Provinces, and also on Sakhalin Island. Precious and semi-precious stones are found mostly in the Altai region (Tomsk Province), Sayan region (Irkutsk Province), and in Transbaikal Territory. The most important Siberian stones are beryl, aquamarine, topaz, tourmaline, jasper, jade, and jet. Monoliths of jasper in the Altai region sometimes reach enormous dimensions; one of the vases in the Hermitage in Leningrad made from Siberian jasper weighs 20 tons. The Sayan region is particularly rich in jade and lazurite, while the southeastern portion of Transbaikal Territory abounds in beryl, tourmaline, and topaz.

Mineral waters and springs are known all over Siberia, but only a few of them are used for curative purposes. Transbaikal Territory, it is said, has no competitors in the world in the number and variety of springs. This feature, combined with a salubrious climate (it is claimed that tuberculosis does not exist in Transbaikal Territory), suggests potentialities in the way of development as a health resort.

ECONOMIC CONDITIONS

In Siberia, as everywhere else, economic factors profoundly modify the fundamental effects of environment and the development and utilization of the resources. Until the economic conditions become favorable throughout the land to the untrammeled development of industry, Siberia must labor under a handicap.

TRANSPORTATION

The word "transportation" should be written in large letters over the map of Siberia and should always be borne in mind when discussing this country. The vastness of the country, where inland points in south and central Siberia are 3,000 miles from tidewater, and where its large cities are a thousand miles apart, makes transportation, or, to be more accurate low-cost transportation, the most pressing problem bearing on the economic development of Siberia. Its significance will become still more obvious when one recalls that Siberia's land neighbors are mostly of low economic developments which are not in a position either to supply its needs or to absorb its surplus products. Furthermore, Siberia is located in a remote corner of the globe, far from important commercial centers and lanes of traffic. Furthermore, Siberia is not easily accessible. Although it has a long coast line, its coastal lands and interior, because of this, are not accessible for transportation. On the northern coast the shore waters are frozen most of

the year, retarding development of the hinterland. Moreover, the Arctic Ocean is not an important trade highway. On the eastern shore in Bering Sea and the Sea of Okhotsk, harbors are open to navigation for a somewhat longer period than along the Arctic Ocean, but mountain ranges front the ocean, obstructing communication with the interior. On the south are high mountains and deserts. On the west the Urals and great distances separate Siberia from European Russia. Thus the most accessible traffic channel is from the east, the valley of the Amur River which leads to the Pacific Ocean.

FIGURE 8.—A Siberian wagon train bringing grain to the railway, reminiscent of early days in the American West.

All these conditions are a heavy handicap for the development of Siberia. This point is well illustrated by the rapid transformation which has occurred in districts adjacent to the Trans-Siberian Railroad. During the years 1900 to 1909 population along the railroad increased from 6,000,000 to 9,000,000 and freight traffic increased from 700,000 tons to over 3,000,000 tons. New industries such as coal mining and dairying developed, towns grew up almost overnight and exportation of native products increased rapidly, giving greater purchasing power to the population. With this last came larger imports.

In Siberia, poor in capital, railroad construction can not be expected to cover adequately that vast country. Furthermore, the necessarily high railroad freight charges over long distances can be borne only by the more valuable products, such as butter, furs, and hides. The bulk of Siberian exports, grains, timber, and minerals, cannot stand high freight tariffs. Therefore it is imperative that the existing and projected railroads should be linked with Siberia's waterways.

Roads for vehicular traffic are important locally. The plains of western Siberia, particularly the steppes, are said to be fit for automobiles most of the year, even without the construction of any roads. Automobiles, consequently, may become a great factor in developing this region as well as some parts of eastern Siberia. The enterprising character of Siberia's population, their willingness to adopt new methods, and the possibilities of oil supplies for automobiles and tractors, not only from the Caspian region in the west and Sakhalin Island in the east, but also from boghead coal fields in central Siberia, midway between the agricultural regions in the west and mining regions in the east will aid in developing the country.

RAILROADS

Siberia's trade with European Russia and foreign markets practically started with the construction of its first railroad, the great Trans-Siberian railway, which is the longest single railroad line in the world. Its length from Petrograd to its terminal in Vladivostok is over 5,400 miles. The present imperfections of Siberian waterways for transportation purposes such as short ice-free season for navigation, unimproved conditions of the channels, and lack of connecting links from basin to basin, add to the importance of the railroads.

The Trans-Siberian Railroad was built by the Russian government at an estimated cost of over $1,000,000,000. It was built in several divisions simultaneously. (a) The Western division, from Cheliabinsk to Novo-Nikolayevsk. Cheliabinsk is a junction where two lines converge, the one from Petrograd via

Ekaterinburg and Perm; the other from Moscow via Samara. This division was opened in October, 1896, and traffic on it became so heavy that in 1912 a new line was built from Omsk to Tiumen, serving as a second track, and at the same time shortening the hauls to Ekaterinburg by 90 miles. (b) Middle Siberian division, from Novo-Nikolayevsk to Irkutsk. (c) Transbaikal, from Irkutsk to Kuenga. At first trains were ferried over Lake Baikal or across it on ice in winter. But later a railroad was built around the southern shore of the lake. (d) From Karymskaya station of the Transbaikal division a branch line runs to Manchouli station, whence the Chinese Eastern Division branches off to Harbin and Vladivostok. (e) Amur division from Kuenga station to Khabarovsk. (f) Ussuri division, from Khabarovsk to Vladivostok. The Ussuri and the Chinese Eastern divisions meet at Nikolsk-Ussurlisk. The Chinese Eastern Railroad gives a shorter haul between Vladivostok, Lake Baikal, and points farther west by 560 miles, as compared with the Amur division. Its disadvantage from the Russian point of view is the fact that this line traverses Chinese territory. The Amur Railroad follows the Amur River anywhere from 10 to 80 miles from the stream. Short branches from the main line extend to Amur River ports. From Omsk to Karymskaya and from Nikolsk-Ussurlisk to Vladivostok the Trans-Siberian Railroad is double tracked. Thus, taking into consideration that two lines extend west from Omsk, and that east of Karymskaya two lines also are in operation—the Amur railway and the Chinese Eastern railway—the Trans-Siberian Railroad may be said to have two tracks on its entire length.

The total length of all Siberian railways, not including the double tracks or sidings, but including all branches built by the Russian government, is 6,834 miles. The most important branches are Taiga-Tomsk and Petropavlosk—Kokchetav in western Siberia; Verkhne-Udinsk-Kiakhta on the Mongolian border, which is to be extended to Urga, the capitol of Mongolia; Harbin-Changchun on the Chinese Eastern Railroad; and Ugolnaya-Suchan on the Ussuri Railroad in eastern Siberia.

FIGURE 9.—River transportation such as this at Khabarovsk is most important in Siberia. Until more railways are built, much of the land must depend upon the rivers for movement of goods.

Private interests have built several important feeders to the Trans-Siberian railway. (a) The Altai Railroad, from Novo-Nikolayevsk to Semipalatinsk, with a branch to Biysk, 500 miles long, serves a well-populated region with fertile soil. (b) The Kolchugino Railroad, from Yurga Station to Kuznetzk, is in the heart of the coal basin of the same name. It is reported that this line extends to the Telbes iron deposits. Its total length is about 350 miles. (c) The Kulundinskaya Railroad, from Tatarskaya to Slavgorod, is nearly 200 miles long. (d) The Achinsk-Minusinsk Railroad covers a distance of nearly 300

miles. The last two traverse rich agricultural and mining districts.

The total length of Siberian railroads open to traffic is more than 8,600 miles. The per capita trackage in Siberia is only one-fourth that in the United States, while Siberia had (1920) for each 1,000 square miles but one-fiftieth the mileage of the United States. Many important towns, even in better settled parts of Siberia, are a hundred miles or more from a railroad. Akmolinsk and Zmeinogorsk are more than 300 miles away, KaraKalinsk 500 miles, and Ust-Kamenogorsk 600 miles. In eastern Siberia, Bodaibo and Olekminsk in the gold mining region are 1,200 and 1,400 miles from a railroad. In order to visualize what this means these distances may be compared with some in the United States. From New York by rail it is more than 400 miles to Buffalo, nearly 600 miles to Cleveland, and better than 1,000 miles to Omaha. In order to remedy this situation and to facilitate colonization of new regions in Siberia several new railroad lines have been projected. Among them the most important is the South Siberian line, to run from Semipalatinsk to Orsk between 200 and 270 miles south of the Trans-Siberian railway. This line would connect western Siberia with Turkestan and the Black Sea ports, facilitating shipments of grain into Turkestan, thus releasing the land of the latter for cotton growing. Another line has been projected from Alexeyevsk on the Amur Railroad to Nikolayevsk-on-Amur. The latter port is nearer to Seattle than are Vladivostok and Dairen by 600 and 1,700 miles respectively. Other projects called for a line running north of the Trans-Siberian Railroad, and between various inland points and river ports.

WAGON ROADS

The total length of all wagon roads in Siberia slightly exceeds 90,000 miles; of these only 2,400 miles are improved. In spite of the primitive conditions of these roads they may be used quite extensively owing to light rainfall and snowfall. The flatness of western Siberia and the great number of horses also favor vehicular traffic over these roads. The greatest obstacles to travel over them are encountered during fall or spring, when rivers and lakes are freezing or thawing. The majority of these roads, particularly in western Siberia, are said to be passable for automobiles. One of these roads, paralleling the Trans-Siberian Railroad, is the great Siberian "Trakt" leading from Moscow to Vladivostok. Of this road and the sufferings of its involuntary travelers many a book has been written.

WATER TRANSPORTATION

In western Siberia the rivers flow through plains in sluggish, winding courses. The gentle gradient makes them navigable almost to their sources. In eastern Siberia, where the highlands are situated near the coast, the rivers are shorter, straighter, and have a more rapid current than in western Siberia.

These waterways are well distributed. The largest rivers, the Ob, the Yenisei, and the Lena flow from south to north, while their tributaries generally have an east-west course. The Amur, however, flows from west to east, while the courses of most of its tributaries lie north and south. The Ob is navigable from its mouth all the way into China while the Yenisei has its source in Mongolia. The Lena and Amur Rivers are navigable for more than 2,000 miles from their mouths. Thus these waterways may afford the much needed low-cost transportation from practically any inland point in Siberia.

Waterways assume particularly great importance as goods carriers, owing to the small mileage of the existing railways and wagon roads. These waterways may provide an outlet at low freight rates for the Siberian producers of bulky and low-priced commodities. These rivers may afford a manifold service for long-distance transportation of goods, for local traffic, as feeders to the railways,

and as a means for inland distribution of goods brought by the latter to the river ports. The total length of Siberian rivers is given as 81,500 miles, of which about 60,000 miles are available for communication during the ice-free season.

The period of river navigation there is longer than it is usually believed to be. In the upper sources of the Ob, Yenisei, Lena, and Amur Rivers the navigation period lasts from 180 to 203 days, in the middle courses from 176 to 193 days, and on the lower courses from 152 to 175 days. At the mouths of the first three rivers the navigation period lasts about three months. The fullest use of Siberian rivers is impossible because of shallows, bars, and rapids. Their basins furthermore, are isolated from each other, reducing their immediate importance for transportation. In spite of these handicaps Siberian rivers support a considerable traffic. In 1913, 1,600,000 tons were shipped over the Ob River, 1,300,000 tons on the Amur River, and 200,000 tons by way of the Yenisei River.

When the rivers are improved and linked with each other, permitting movement of goods from one basin to another, they will doubtless carry a much larger tonnage. Before the World War a commission of experts investigated the Siberian waterways and recommended the building of an uninterrupted waterway from the Pacific to the Urals, and the connection of the Ob River with the Volga River. This project is feasible without any engineering difficulties and would require a comparatively small outlay of capital.

Development of waterways may not be so spectacular nor so rapid as in the case of the Trans-Siberian Railroad where the results were mostly confined to a strip along the right of way. It may, nevertheless, exceed the latter in magnitude, because a low-cost all-water transportation route to world markets will affect larger areas with great possibilities for development. This plan for building canals and canalizing portions of the rivers involves many economic, geographic, and engineering problems.

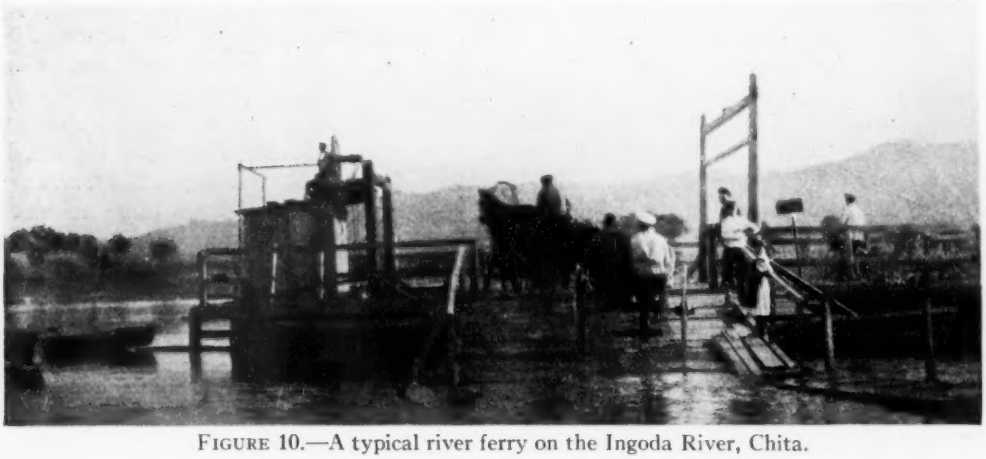

FIGURE 10.—A typical river ferry on the Ingoda River, Chita.

Northern Route

The full potentialities of the largest Siberian rivers, the Ob, Yenisei, and Lena, will be fully realized only when commercial navigation exists in the Arctic Ocean. The mere suggestion of this northern route brings smiles, head shaking, and retorts: "This is impossible." Such statements disregard the facts. The Arctic Ocean has been navigated from both directions, from the west via the Kara Sea, and from the east

via Bering Strait. Russians and Norwegians have used the Kara Sea route for centuries. In the last quarter of the nineteenth century about one hundred sailing vessels and steamers plied the Kara Sea in both directions. Some of them ascended the Yenisei River to the town of Yeniseisk, 1,300 miles from tidewater, and even up to Krasnoyarsk, 260 miles farther south, on the Trans-Siberian Railroad and in the very heart of Siberia. Beginning with 1913 regular sailings year after year were maintained via the Kara Sea to the mouth of the Ob and Yenisei Rivers. In 1900 a Russian expedition reached the mouth of the Yenisei River via Bering Strait. In 1911 to 1913 the Russian Volunteer Fleet made regular trips from Vladivostok via Bering Strait to the mouth of the Kolyma River. These sailings were interrupted by the World War, but were resumed in 1926.

FIGURE 11.—Vladivostok, the eastern terminus of the Trans-Siberian Railway, is an enterprising busy city, of great promise. With increased occupancy and development of its hinterland, it will probably become a great city indeed.

Navigation in these waters, particularly in the Kara Sea, would be no more difficult for an experienced skipper than in any other polar waters, if, in addition to such ordinary services as lighthouses, buoys, surveys and pilot service, are provided such modern aids to navigation as meteorological stations, radio stations (eight such stations were in operation around the Kara Sea in 1923), hydroplanes, and similar agencies for reporting ice conditions and ice movements. Experience has proved that during the summer months the ordinary type of vessels can navigate these waters without difficulty.

The whole northern coast of Siberia has been charted with the exception of a few hundred miles between the mouth of the Yenisei River and Cape Cheliuskin. This uncharted area is adjacent to the portion of the country whose commercial possibilities are least known. It is at the end of routes to the Arctic Ocean both from the west and the east, so would not interfere with traffic from either direction.

The Kara Sea does not freeze over its entire surface even in winter, but ice is formed for the most part near the shore. No icebergs have been reported in these waters and the season of navigation varies from one and one-half to two or three months. The so-called "white" nights facilitate navigation in these waters. The presence of numerous coal deposits along the northern Siberian shores may have an important bearing on the development of navigation there.

Should the northern route materialize it may materially affect the world lines of commerce. Nordenskiold used this route on his famous voyage from the Atlantic Ocean along Siberian northern

shores to the Pacific Ocean. At present, New York, via the Panama Canal, is about 3,000 miles nearer to Nikolayevsk-on-Amur than Hamburg or London, via the Suez Canal. But by the way of the northern route the distance is in favor of the European ports by some 2,000 miles.

The most serious objection to the Kara Sea route is the short navigation period of about two months. The building of canals or railroads terminating at various points on the Arctic Ocean west of the Kara Sea has been projected because there the navigation season is longer than in the Kara Sea. These projects, however, fail to consider the Yenisei basin and in addition the longer railroad haul will result in higher freight charges.

Some authorities claim that during one navigation season several sailings can be made from European ports to those in the Kara Sea, if this route is equipped with the necessary aids to mariners, those would assist in steering the right course, thus avoiding loss of time in looking for a channel in the ice, and also if provided with efficient unloading facilities and other means to cut down the idle time of vessels in Siberian ports. Under proper organization it is believed that more goods can be carried via the Kara Sea during its short open season than by rail during the entire year.

The question arises as to whether (a) this route would be more economical than present routes, and (b) whether there would be enough freight to warrant the expense for development of the Kara Sea route. The answer to the first question is given by the persistent efforts of business men, Russians and foreigners alike, to open this route. It was estimated just before the war that the cost of shipping a long ton of wheat from western Siberia to London by combined rail and water route would have been from $15 to $21, while via the Kara Sea route this cost would have been from $8 to $11; a saving of practically 50 per cent in freight costs.

The potential volume of goods which may be exported via the northern route is difficult to estimate under present conditions. Siberia may have export surpluses of grains, timber, minerals, animal products, and textile fibers. Should Siberian resources as known so far, be developed to any considerable degree, grain exports may reach 750,000,000 bushels of wheat and 1,000,000,000 bushels of oats which would provide about 50,000,000 tons of freight. For timber exports this all-water route would be extremely important. Forests in the basins of the Ob and Yenisei Rivers may supply annually for export from 300,000,000 to 500,000,000 cubic feet of timber, equivalent to 8,000,000 to 12,000,000 long tons. To these amounts might be added exports of other Siberian industries such as butter, hides, skins, wool, bristles, meat and cotton from Turkestan.

Imports of machinery and supplies for Siberian industries would supply freight in the other direction, which might be augmented further by transit goods from Chinese Turkestan down the Ob River, and from Mongolia. The Yenisei River in northern Mongolia and the Selenga River flowing into Lake Baikal from northeastern Mongolia might collect freight from this region. Thus the volume of goods which might be offered for transportation over the Kara Sea route would fill a large number of vessels. Through the eastern part of the northern route goods may be exported from and supplies and machinery brought into the vast Lena-Kolyma mining district, rich in gold, coal, salt, and other metals and minerals.

PORTS

At present Siberia has only two ports of any importance, Vladivostok and Nikolayevsk-on-Amur, both on the Pacific Coast. Vladivostok, the terminal of the Trans-Siberian Railroad, has a fairly well-equipped harbor, which can be kept open the year round. Nikolayevsk-on-Amur, at the mouth of the Amur River,

is far from any railway line. The bar at the mouth of the Amur River prevents entrance of ocean-going vessels into the river, forcing them to reload in the open roadstead. If the bar is dredged and the port is provided with modern equipment Nikolayevsk-on-Amur may become an important gateway for the rich mining, agricultural, and forest region of the Amur basin, as well as for a considerable part of Manchuria for which the Amur River is a natural outlet. Along the coast of the Okhotsk Sea, Tartar Straits, and Japan Sea there are a number of bays which may serve as harbors, the best of them being De Kastri Bay and Imperial Harbor. De Kastri Bay may be easily connected with the Amur River by a canal or by a short railroad about thirty miles long, thus avoiding the most difficult stretch of the route to Nikolayevsk-on-Amur and shortening the distance to the sea by several hundred miles, and affording a longer open season for navigation than at the port farther north.

COMMUNICATIONS

Telegraph lines usually parallel the railroads, then branch off into valleys of the large rivers of the north, and in the south to the western and northern boundary of Mongolia. There are quite a number of wireless stations. Some of them serve the needs of the Kara Sea route; others are for communication with Kamchatka and Chukotsk Peninsula, while still others are for inland communication between various Siberian towns and also with European Russia. Telephone installations are rare and exist in but few cities and towns.

INDUSTRY

Siberia, an agricultural country remote from commercial centers, has to provide most of the manufactured goods needed. These simple requirements have been mostly the products of home industries known as "the Kustar." Machinery has to be brought from far away places, making it expensive to establish as well as to run factories. Therefore the small amount of capital that has been available in Siberia has been preferably invested in trade, which has promised higher and quicker returns. But when conditions there become favorable for large economic development and the transportation problem is solved, Siberia will become a consuming market of considerable magnitude for a great many articles. Agriculture will require agricultural implements, grain elevators, equipment for dairies, flour mills, breweries, distilleries, and tanneries. The mining industry will need equipment for its mines, its metallurgical plants, and machine shops, also road-building machinery, tractors and power plants. The forest industry will require logging machinery, equipment for sawmills, pulp, cellulose, paper mills and wood distilleries. Public utilities of all kinds, power plants, cement and brick works, will be demanded by cities and towns. These potentialities, combined with the abundance of raw materials and power, such as coal, wood, and water-power have been recognized, and just prior to the World War, capital, largely foreign, began to flow into Siberian industries. When conditions once more become normal this trend may be expected to assert itself with renewed vigor.

According to incomplete returns for 1913 the value of the total production of recorded industrial undertakings was $53,000,000, of which nearly half, $25,000,000 came from mining, over one-third or nearly $19,000,000 from foodstuffs industries, mostly flour mills, distilleries, and breweries. Metallurgical plants and sawmills were credited with $2,000,000 each and the animal industry with a little more than $3,000,000 mostly in leather factories. Thus only industries which could obtain an abundant and cheap supply of basic materials, and for whose products there was a considerable demand, have made their appearance in Siberia. Nevertheless, in spite of large supplies of raw

FIGURE 12.—The Barakholka—principal market place in Chita.

materials, fuel and waterpower, and of a considerable local demand, paper mills, iron works, textile mills, sugar factories and glassware factories, have been practically non-existent.

TRADE

Before the construction of the Trans-Siberian Railroad, owing to lack of communication and transportation facilities and to the great distance of Siberia's consuming centers from Moscow and foreign manufacturers, Siberian trade has been handled by a few powerful firms who enjoyed the long-term credits necessary to carry on the slow-moving trade over that vast country. These firms acted in the double capacity of exporters and importers and ruled as monopolists, charging high prices for their wares and paying very little for the furs, the most important cash goods of the Siberian population. Naturally such conditions affected adversely the purchasing power of the population, and imports were restricted to a few indispensable items. The completion of the railways changed the status of affairs. Numerous trading centers have sprung up along these lines, dispensing to a considerable extent with the fairs which formerly were the chief trade distributing media. Owing to better transportation facilities the manufacturer and exporter have been brought nearer to the importer through numerous smaller traders as well as through the larger companies. Goods have moved more rapidly, and prices of imported goods have come down while those of exported ones have gone up. This change, combined with the growing demand for raw materials in world markets, has increased the purchasing power of the Siberian population so that its trade has shown signs of healthy expansion. It is estimated that in the last ten years before the World War Siberian home trade increased from $31,000,000 to $77,000,000. During the period from 1910 to 1913 exports averaged $14,000,000 and imports over $52,000,000.

UTILIZATION OF THE RUGGED SAN JUANS*

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THE San Juan district of southwestern Colorado is one of magnificent mountain forms. It is a region of great scenic beauty. Most of the summit area is from 12,000 to 13,000 feet above the sea and there are more than 200 peaks that rise to elevations above 13,000 feet, and at least 13 peaks that rise to elevations of over 14,000 feet. Near the summits broad, open amphitheatral basins are found where snows formerly collected and were compressed by their own weight into glaciers. Canyons 3,000 to 4,000 feet deep are common, and at a few places the depths of the canyons measure 5,000 feet.

During the summer bare rock surfaces and perennial snow fields dominate in the summit areas; short grasses characterize the alpine pasture lands; forests clothe the middle slopes of the mountains; tall grasses grow most naturally in the valley lowlands and the blue-green of the sagebrush gives character to the semi-arid surfaces of the bordering plateaus.

The mountain landscape contains thousands of beautiful lakes and a number of artificial reservoirs, where the waters from the melting snows and the heavy rains are held in reserve for use in the bordering lowlands during the latter part of the growing season.

FIGURE 1.—The Northwest Mountain Front, Colorado. The plateau surface in the foreground is at about 7,000. The highest summits are about 14,000 feet above sea level.

In winter this lofty mountain region is mantled with snow that attains in places a depth of 20 feet. The contours of the landscape are softened and the rich colors of the summer season are replaced by the delicate blue-gray shadows among the great snow banks.

HISTORY

Early in the seventies of the nineteenth century, a number of hardy pioneer prospectors visited this bold, rugged mountain country. Reports of mineral wealth had reached them from

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the Indians who frequented this range on their hunting expeditions, or spent their summers in the beautiful mountain canyons where fish and berries were abundant and where grass for their livestock was luxuriant.

The prospectors worked their way through the valley bottoms, occasionally testing the stream gravels for placer gold and, as in most of the great mining regions of the world, some rich placer deposits were found and worked. But the search for the true mineral veins and lodes led these hardy prospectors higher and higher into the mountains. They scrambled along precipitous ledges, even to the summits of many of the loftier peaks. They examined with great care the walls of the deep canyons, and at numerous places where surface conditions looked promising, they sank test holes or drove prospecting tunnels.

As the years passed great mining enterprises were undertaken and millions of dollars' worth of ore were taken from these hills; lumbermen, ranchmen, and tourists have followed; the study of human occupation is richly interesting.

THE PHYSICAL HISTORY

Late in geologic time a huge dome 120 miles long from east to west and 70 miles wide began to rise in this part of the continent. As it rose rains fell upon this rising mass and valleys were cut by the waters that flowed radially down its slopes. The land continued to rise; the streams cut deeper and deeper until mountains were carved out of the great uplifted mass of rock. Snows accumulated and glaciers were formed that completed their work and were melted away. That generation of San Juan Mountains was nearly removed by the agents of erosion when a period of vulcanism began.

FIGURE 2.—Uncompahgre Valley looking upstream over the site of the town of Ouray. The upper limit of ranchlands appears in the foreground view.

Volcanoes broke forth at numerous localities. Through great fissures lavas came to the surface and poured out over the landscape. Large quantities of frag-

mental materials were thrown into the air. They settled and formed in layers thousands of feet thick as breccias or tuffs. The accumulation of the lavas and of the fragmental material built up in time a widespread volcanic plateau in this portion of Colorado. The winds, the rains, and changes in temperature all tended to disintegrate this mass of rock. Streams cut new valleys and in time the volcanic plateau was carved into the rugged mountain forms of today.

Among the summit regions of these mountains snows accumulated, glaciers formed, advanced to the lowlands bordering the range and finally melted away. During at least three distinct epochs such alpine glaciers formed in these mountains, completed their work and disappeared. They have left records of great erosive activity and of their work of carrying and depositing débris.

The present topography of these mountains is, therefore, the result of the dissection of a great domal structure into a mountain range, its later burial in part by volcanic débris and re-dissection by running water and valley glaciers. The ice has changed the canyons from the characteristic V-shaped forms that result from stream erosion in regions of high altitude to the U-shaped forms of glaciated gorges. The moraines left by the ice have ponded the drainage at many places, thus causing most of the lakes and natural reservoirs in the San Juan Mountains.

THE CLIMATE

Winds and Rainfall.—This mountain area is located in the midst of the belt of westerlies. It is near the western margin of the southern division of the Rocky Mountains and has a rainfall more evenly distributed throughout the year than the lands farther to the east.

During the winter months the precipitation comes largely with the moisture-bearing winds from the Pacific Ocean. As these winds rise in crossing the mountain area, the moisture content is reduced and precipitated in the form of snow which in some cases reaches a depth of nearly 200 inches or a little over 16 feet.

In the summer time the rainfall derived from the western winds is augmented by moisture brought by winds from the Gulf of Mexico. This influx of warm moist winds from the Gulf is due largely to the low pressure conditions over the hot interior plateaus and the relatively high pressure over the Gulf. The resulting slow movement of air northward, frequently augmented by cyclones moving eastward across the United States,

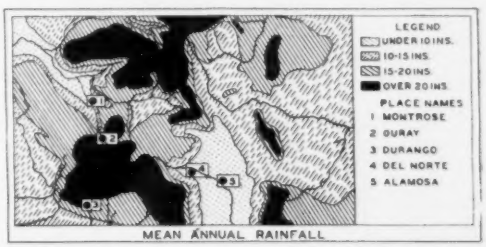

FIGURE 3.—Mean annual rainfall of the San Juan Region.

results in warm moist southerly winds in the San Juans, and as these winds strike the mountains they are cooled and are forced to give up a portion of their moisture content.

Figure 3 shows the mean annual precipitation of southwestern Colorado. In the foothill belt the annual rainfall commonly ranges from 10 to 15 inches; on the lower mountain slopes from 15 to 20 inches, while in the higher mountain area it is each year over 20 inches. The snowfall has been recorded at a few of the settlements within the mountain area. At Rico the mean annual snowfall is 148 inches, and at Silverton it is 196 inches, or a little more than 14 feet.

Mean Summer Temperature.—The lower valleys bordering the range record a temperature of 60 to 65 degrees; the lower slopes of the mountains 55 to 60 degrees, while in the high mountain areas it is commonly below 55 degrees.

Those who have lived in these high mountain areas during the summer appreciate that the temperature often falls to the freezing point. The water in the pools around the camp is frequently crusted over with ice when one wakes in

the morning. Snow may fall at any time, and it is almost certain to fall a few times during each month of the year.

During the day the bright sun has that healthful and invigorating influence common to the high mountain atmosphere. In the cool of the evening, when campers rest about their open fires, the bracing air lends a freshness which often gives zest to the camp-fire stories. As the night advances, rapid radiation of heat from the high mountain areas reduces the temperature so greatly that it is necessary to have an abundance of warm woolen bedding in order to be comfortable even during the warmest months of the summer season. Many a camper unfamiliar with the high mountain conditions of radiation has crawled out of bed a little before sunrise, commenting vigorously upon the temperature conditions, as he shivered about in his efforts to build a little fire. He should have provided himself with warm bedding, but he disdained the advice of the old-timer. Summer nights in these high mountain regions are much colder than those in central Alaska, and a camping outfit suitable for that far northern country during the summer season is not adequate for a camping season in the higher altitudes of the San Juan region.

Average Length of the Frostless Season.—Figure 4 presents graphically the

FIGURE 4.—Average length of the frostless season in the mountain region.

average lengths of the so-called growing season. These are taken from the date of the last killing frost in the spring and the first killing frost in the fall. In the valley bottoms and in the lower lands bordering the range, the growing season is from 100 to 125 days. Nearer the mountains and on the lower slopes of the range the frost-free period varies from 75 to 100 days; and in the higher mountain area, it is less than 75 days. If we proceed downstream to lower and lower altitudes, as we would in traveling northward within the Valley of the Uncompahgre, we find the growing season increased to 125 and 150 days, and a little farther to the northward, it is found to exceed 150 days.

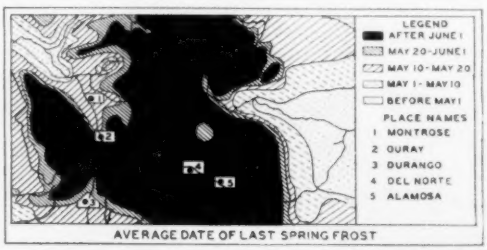

FIGURE 5.—Map showing average date of the last killing frost.

The date of the last spring frost is of prime significance to those engaged in fruit raising and agriculture. The data available, (Fig. 5), show that in the high mountain area, or even in the San Luis Valley, it may come after June first, which means that a frost may occur at any time during the year. On the intermediate slopes of the mountains there is a belt where the last killing frost may be expected somewhere between May 20 and June 1. A little farther out and at a lower elevation, the last frost is anticipated between May 10 and May 20, and as we proceed farther and farther from the range, it is expected earlier and earlier in the year.

HUMAN OCCUPATION

The Establishment of Mining Centers.—With the discovery of rich deposits of gold, silver, and the ores of lead and zinc, thousands of people came into this mountain region to seek their fortunes. A number of mining towns sprang up in the eighties. The town of Ouray was located near the north base of the moun-

tains on an alluvial fan built out by a tributary stream into the main valley of the Uncompahgre River. (See Figure 2.) In the valley of the San Miguel River on the western slope, Telluride was built. Rico was built in the heart of a secondary dome on the west flank of the mountain range known as the Rico

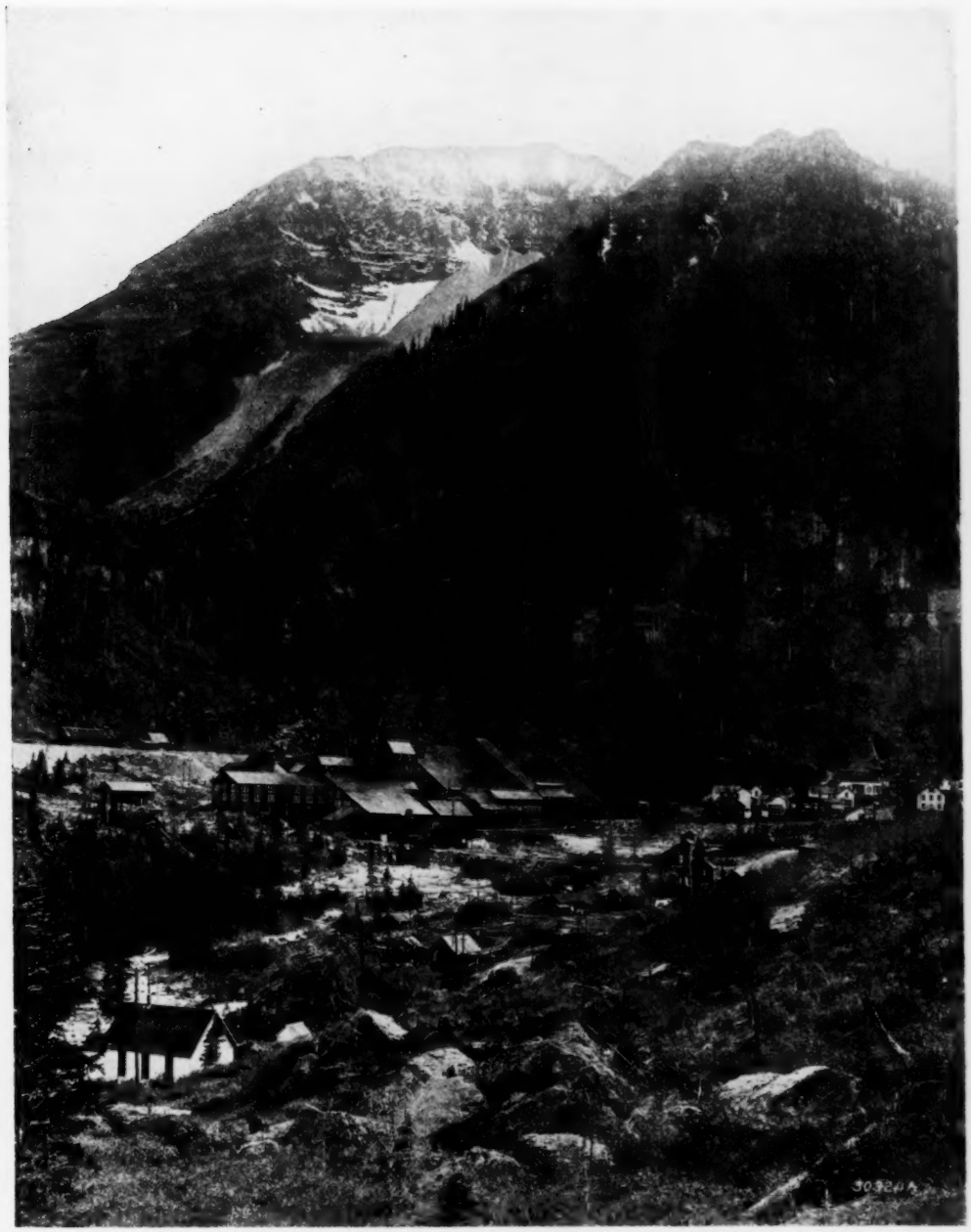

FIGURE 6.—Camp Bird Mill and adjoining laboratories and homes. This mill is located in Canyon Creek about seven miles southwest of Ouray. It is one of the large stamp mills where the gold ores are crushed in the process of concentration. In association with the mill there is a cyanide plant where the finer particles of gold that work through the concentrating plant are taken in solution by the cyanide of potassium and later recovered.

Mountains. Durango, which now serves as a smelting center, was built on the terraces of the Animas River near the south margin of the range. Silverton, also on the Animas, was located in the central portion of the San Juan mountain region. Creede, located on a little tributary of the Rio Grande, is the chief mining center of the eastern slope of the mountains. Lake City, on the Lake Fork of the Gunnison and near the north margin of the mountain area, is another of these towns.

FIGURE 7.—Silverton in the valley of the Animas.

With the exception of Durango, these cities were located as far upstream in the canyons as transportation conditions in the early days of settlement permitted, and where suitable town sites were available. When the days of railroad construction came, in the early nineties, these mining towns were found to be so located that spurs from the main lines of railroad could be built to each one of them. They became termini for the railroads. From Silverton additional spurs were extended farther into the heart of the range; but Ouray, Telluride, Lake City, and Creede still mark that notable break in transportation which takes place when the end of the railroad is reached and goods and passengers must be transferred to the backs of horses or mules. In some instances the transfer has been to wagons, and later, with modern development, to motor trucks. These towns notably illustrate the tendency for centers of population to develop at breaks in transportation facilities.

These cities in the San Juan region have served as social and commercial centers for large portions of the mountain area. To these centers have come the produce and manufactured goods from other sections of the country. All of the supplies necessary for the conduct of the mining business have been received at these cities and distributed to the mines. The products of the mines, usually in the form of concentrates, have been brought to these same towns and there loaded for shipment to smelters or refineries.

Many lesser mining centers have been established still higher in the mountains, far beyond the reach of the railroads, at points where large mines have been developed, or where a number of small mines are operated. This is illustrated at Summitville and Platora in the eastern portion of the mountain area, at Animas Forks, and at Ironton in the central part of the mountain region.

In common with the history of many mining regions, some of the lesser centers, which were prosperous for a time, have ceased to produce, and, for a time at least, are quiet. Today such deserted mining camps are scenes of desolation. A lone watchman may take care of the more important properties, but for the most part the streets and the tramways, the shops and the town hall, that were formerly scenes of great activity, are absolutely quiet. One may pass today through these former centers of activity where hope and confidence guided thousands of people in their search for mineral wealth, and yet see no one. Perchance, a dweller from the lower portions of the range, or a laborer from a freshly established mining camp, may be heard tearing down the old houses to secure building material or fire wood for his new home.

The Influence of Climatic Conditions upon Mining.—Those who came into the mountain region in search of mineral wealth gave little heed to climatic conditions. Such men will go almost anywhere if there is a fair chance of discovering a body of ore. To be sure, the heavy snowfalls of winter and the severe cold at high altitudes affected their building plans, and the provisioning of mining camps for the winter season. The heavy rainfall of the region had provided luxuriant forests upon which these prospectors drew most freely for building materials and for mine timbers. The mountain streams with their many waterfalls and rapids provided an abundance of pure, clear waters which could be used in the stamp mills, the concentrating plants, and for the generation of electric power. On the whole, the mining industry of the San Juan mountains is greatly indebted to the favorable climatic conditions which have made possible excellent forests and an abundance of electric power. Electricity is being carried over the mountains to several mining centers and then taken into the mines to illuminate the tunnels and shafts of this underground world.

Second Stage in Settlement.—Following

FIGURE 8.—A homestead in the San Juan National Forest. The bottom of the valley is here used for general farming.

the great influx of prospectors and miners, there came into the mountain region a group of settlers who were attracted by the broad, fertile lowlands in the valley bottoms. These were the ranchmen who saw in the pasture lands of the mountains the possibilities of producing hay and grain for live stock, and many of the vegetables needed for home consumption. They could carry on dairy farming in the rich grasslands of the lowlands, and produce milk, butter, and cheese for their local needs. They could sell whatever surplus they had from the dairying industry in the mining towns. Little by little the rich alluvial plains in the valley bottoms were taken up as homesteads. (Figure 8.) Cattle, horses, and sheep were driven for the summer season into the mountain forests, or high above the forests among the grasslands of the Alpine pastures. When fall came, the stock was brought into the lowland pastures for the winter. Adjustments proceeded just as they have in many other regions of lofty mountains. Scenes were being introduced into the great human drama similar to those common in the Alps of Switzerland, Italy, and Austria, or among the Carpathian mountains of Central Europe or the Pamir of Central Asia.

Nearly every available acre of river bottom has now been put under cultivation. The narrow terraces of the Lake Fork of the Gunnison serve as hay fields and some have been planted with alfalfa; the broad lowlands of the valley of the Dallas contain a rich ranchland area.

In response to the development of an agricultural and grazing life in the valley of the Uncompahgre, a number of smaller towns have been developed. Ridgway,

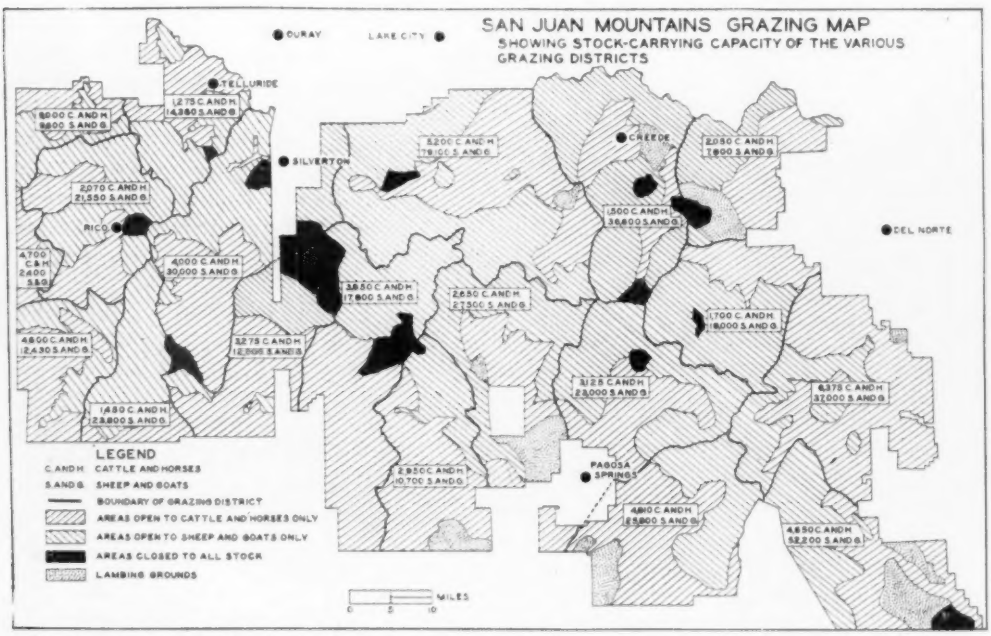

FIGURE 9.—Grazing lands of the San Juan Mountain Area. Data furnished by the U. S. Bureau of Forestry.

a ranching center at the junction of the Dallas and Uncompahgre, has little interest in the mineral resources of the area. Farther downstream are Eldredge and Colona, Uncompahgre and Montrose. The settlements in the valley of the Rio Grande are Del Norte, Monto Vista, and Alamosa.

With decreasing altitude, as we follow down the valley of the Uncompahgre,

the climate becomes suitable for fruit raising. In the vicinity of Colona and Uncompahgre, and especially at Montrose, there are large and successful orchards. During certain seasons the shipment of fresh fruit has been delayed by imperfect transportation facilities, and the local fruit growers have established a canning factory. In the broad lowlands of the valley of the Uncompahgre River, many hundreds of acres are annually planted to sugar beets.

At the southwest margin of the mountain in the vicinity of Mancos the broad terrace lowlands are devoted to ranch life. A combination of agriculture and stock raising has made possible prosperous communities on all these terraces.

Near the south margin of the mountain area and extending southward for many miles, even into New Mexico, the modern flood plain and the stream terraces of the Animas Valley have been appropriated for general agriculture, or for fruit raising. The valley bottoms and the terraces offer attractive sites for ranchmen. The cattle, horses, and sheep are sent far into the mountains for summer pastures, but they return to the home ranch for winter feeding. In many instances the sheep are taken far away into the plateau country for the winter.

All the valleys about the range present the same aspects of development. The valleys of the Florida, the Vallecito, and the San Juan rivers that flow southward from the mountain area have excellent ranchlands. In the eastern portion of the range, the valley of the Rio Grande is the chief drainage line, and in that valley their broad, alluvial bottom lands and several terraces are suitable for cultivation. For a distance of fully forty miles upstream into the range from Del Norte the valley of the Rio Grande forms continuous ranchland. Virtually every available acre has been appropriated for pasture or for raising hay or alfalfa, or peas or grains. Vegetable farming in excess of home consumption is carried on in many localities, and the surplus is sent to the neighboring cities.

The valley of the Rio Grande and the valley of South Fork have developed a

FIGURE 10.—Broad river bottom with adjoining glacial terraces. The bottom land on the south slope of the San Juan Mountains is under cultivation, and the terraces and distant upland are used for grazing cattle, horses, and sheep.

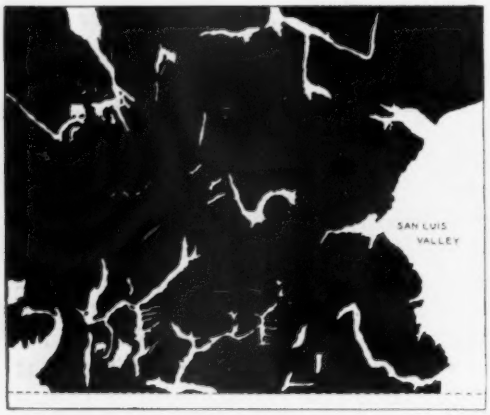

FIGURE 11.—Distribution of crop producing lands within the San Juan Mountain Area. The spaces left white are the lands that may be cultivated and used for general farming.

very notable industry through the cultivation of head lettuce. Acres and acres are now devoted to the production of this one crop. New saw mills have been established to prepare boards for crates suitable to ship this one product to distant markets. Modern methods characterize the industry. Huge motor trucks carry the boxes to the fields, and return with the laden crates to the railroad station at South Fork. A combination of soil, moisture, and temperature conditions in this portion of the range makes possible an unusually crisp and fresh lettuce.

Other valleys of the east slope, such as the Alamosa and the Conejos, have been appropriated by ranchmen. The valley bottoms are fenced off into pastures or hay fields or small grain fields, and attractive homes constructed.

This second stage in the settlement and development of the San Juan region has produced a more permanent population. The people have built attractive homes, constructed churches and school houses, and entered upon a community life with every indication of permanency and prosperity in their settlements. They are producing a very different social environment from that of the mining centers.

IRRIGATION RESERVOIRS

The heavy precipitation in the San Juan mountain area which provides a

FIGURE 12.—Looking east over the valley of the Animas River. The hilly belts on the valley floor are terminal moraines of the Animas Valley glacier. Near the village of Animas the lowlands are used for general farming, the uplands are of some service for grazing, and they supply timber for local consumption.

FIGURE 13.—View in the National Forest where timber has been marked for cutting, and brush piled up to be burned.

surplus of water much needed in the lower portions of the larger valleys and in the bordering plateau regions, has led to the establishment of a number of large reservoirs within the mountain area usually located in the mountain canyons just upstream from a constricted portion of the canyon, where a dam has been built. The Terrace and the La Jara Reservoirs in the southeastern portion of the range hold the surplus waters in the drainage system of the Alamosa and La Jara Creeks respectively. The Farmer's Union Reservoir lies in the valley of the Rio Grande, ponded for a distance of about seven miles. The surplus waters held in this reservoir during the period of heavy run-off are released in the San Luis Valley during the latter part of the growing season. Lake Santa Maria now serves as an irrigation reservoir, and the waters retained there during the flood period of the various streams in that vicinity are turned into the Rio Grande River and withdrawn by irrigation canals and ditches in the San Luis Valley when the crops in that agricultural district need additional water.

The Ignacio Reservoir, located on the upland just west of the Animas River, above the little town of Tacoma, is used in part for the generation of power. The waters are carried to the rim of the canyon of the Animas, and through the power plant where it turns the great wheels and generates electricity. Leaving the power plant and entering the Animas River, the water is then available for irrigation canals farther downstream.

In addition to these artificial reservoirs, the many glacial lakes, and those due to landslides in the mountain area, are natural reservoirs, and some of them are drawn upon by the ranchmen for irrigation purposes.[1]

THE NATIONAL FORESTS

Most of the San Juan area has now been included and set aside in one or

[1] A special paper on the Reservoirs of the San Juan Region was prepared by the author and published in 1918 as Bulletin 685 of the United States Geological Survey.

another of the great National Forests of that part of Colorado. Figure 14 indicates the location of the several National Forests in this mountain area and the distribution of the various forest trees.

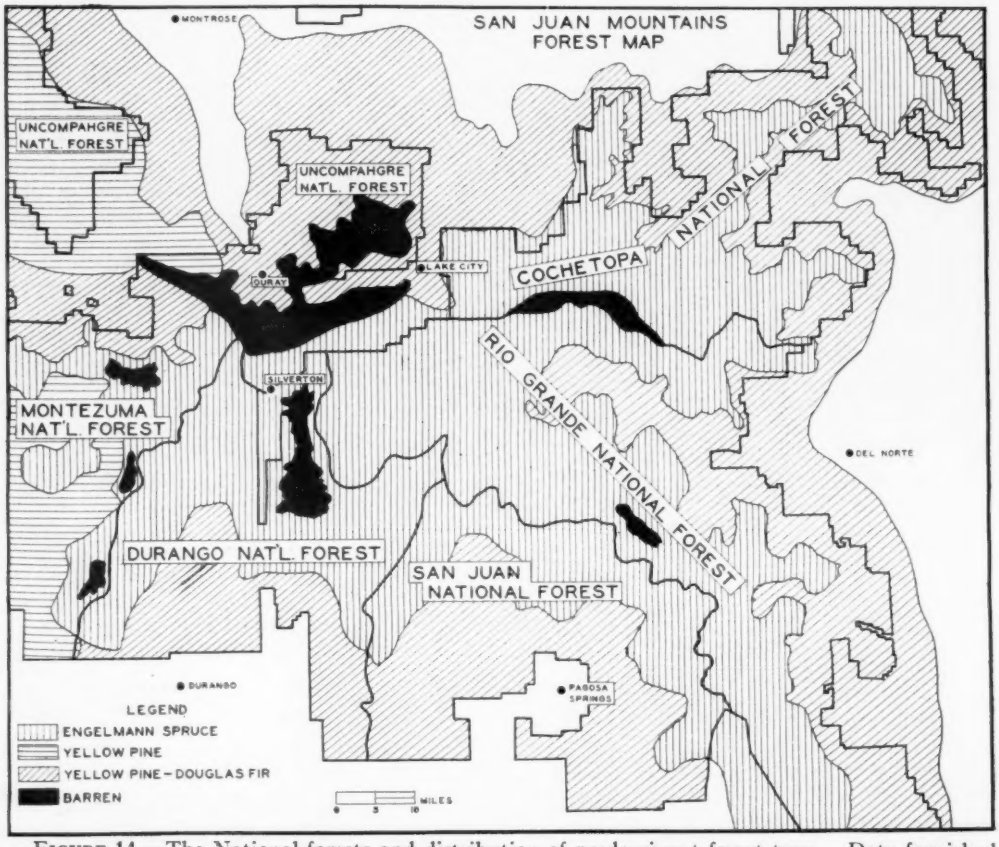

FIGURE 14.—The National forests and distribution of predominant forest trees. Data furnished by the United States Bureau of Forestry.

The following table gives the areas of the forests in this range:

AREAS OF NATIONAL FORESTS IN THE SAN JUAN REGION

	Acres
Cochetopa	908,665
Durango	Not available
Montezuma	696,981
Rio Grande	1,135,778
San Juan	1,239,841
Uncompahgre	778,291

A belt of yellow pine or a belt with mixed yellow pine and Douglas fir lies above the grass-covered lowlands, and higher on the slope a zone of the Engelmann spruce. Above the spruce belt Alpine gardens and some broad, barren tracts constitute the landscape.

The National Forests are organized and conducted by the National Forest Service. Division offices, or headquarters, are located in the larger settlements within the range, and scattered throughout the mountains rangers' cabins break the continuous wilderness. Telephone lines connect these cabins with headquarters and with each other. Mountain trails have been constructed so that the rangers may, on their long rides through the mountains, watch over the forests, guard them from disastrous fires and supervise the grazing. The rangers also mark the timber that is mature and ready for cutting. The ranchmen are permitted to secure timber for their homes, and lumber companies may, on a

FIGURE 15.—Looking up the east fork of the Cimarron in the Lake City quadrangle. Meadow land which serves for pasture is bordered by belts of spruce in the Uncompahgre National Forest.

royalty basis, cut timber in these great forests, all under restrictions.

The ranchmen must appeal to the officers of the national forests for permits to graze cattle, horses, goats, and sheep within the areas, and each year pay a small board bill for the summer grazing of their livestock. The summer board bill for horses is commonly about sixty-five cents per head, for cattle, about thirty-seven cents per head, and for sheep and goats, about seven cents per head. The income from the sale of timber to the saw mills and from the grazing permits has nearly made these forests self-supporting.

On Figure 9 a grazing map shows the grazing districts of the range and their stock-carrying capacity. It is seen that certain areas are open to sheep and goats

FIGURE 16.—Logging in the San Juan National Forest. This is in the belt of the yellow pine.

only, chiefly high mountain areas with grasses and shrubs sufficient for sheep and goats, but not sufficient for cattle or horses.

The areas set aside for cattle and horses are in the better forested regions and on the middle slopes of the mountains. They are above the ranch lands and below the Alpine pastures assigned to sheep and goats. A few areas have been closed to stock entirely. Broad, extensive regions about the margins of the range are open to all kinds of stock, but a few areas have been entirely closed to stock.

numbers the capacity in the several grazing districts for cattle and horses, as well as sheep and goats. When the figures are added, the total capacity within these grazing districts of the San Juan mountain area for cattle and horses is 69,230, and for sheep and goats is found to be 460,440.

In addition to the service to the ranchmen and to the saw mill men, the officers of the National Forests have now selected and improved camping sites available for tourists. Each year the number of summer visitors who frequent the mountains for recreation purposes has in-

FIGURE 17.—Sheep grazing in the Montezuma National Forest on a summer pasture high among the mountains.

The development of sheep raising in the region has necessitated the assignment of certain areas about the range for lambing grounds. These, it will be noted, are relatively low in altitude, and regions where the weather conditions are not severe during the lambing season.

The chart, Figure 9, also shows in

creased rapidly. The tourist business may become the chief industry of the mountain area. Thousands and thousands of campers come by train, or by automobile, and spend from a few days to several weeks within the mountain area. They must purchase their fishing and hunting permits from state officers.

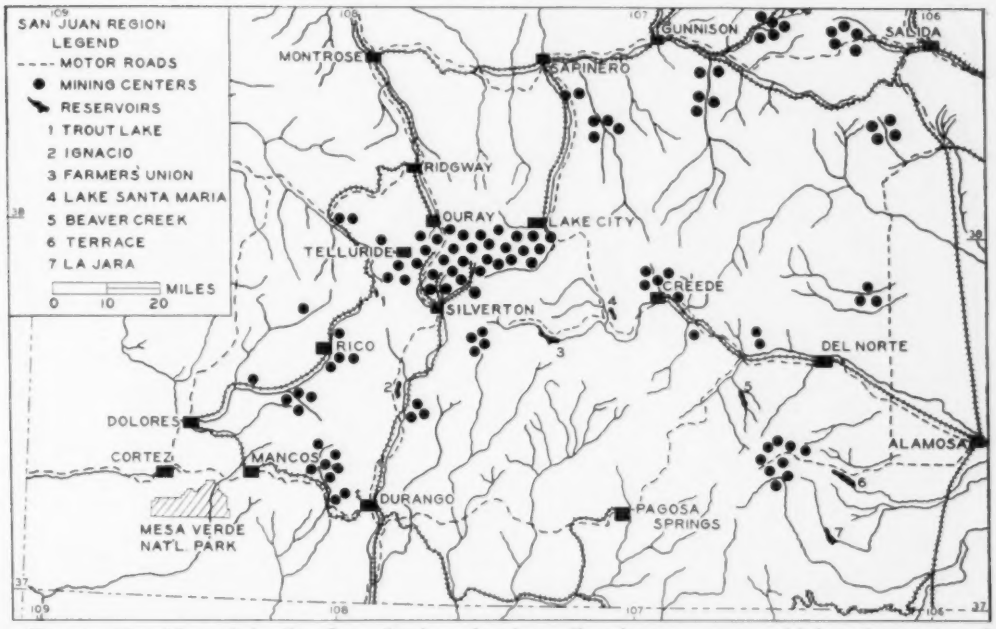

FIGURE 18.—Map of the San Juan Region, showing railroads, auto routes, chief settlements, and mining centers.

and provide themselves with camp supplies very largely from local merchants.

TRANSPORTATION

The railroads within the San Juan mountain area have already been referred to in connection with the development of mining and the location of the chief cities within the mountain area.

From Salida the route over Marshall Pass and down the valley of the Gunnison, through the great Black Canyon gorge of that river and on to Montrose, is a narrow gauge route. The narrow gauge continues into Ouray, and from Ridgway around the west margin of the range to Telluride, Rico, Dolores, and Mancos. The service from Mancos continues eastward to Durango, where it meets the train service, also on a narrow gauge, which comes westward from Antonito. Another narrow gauge route extends into the mountains from Durango to Silverton, and from that city small spurs run somewhat farther into the mountain area. A spur from the southern portion of this encircling narrow gauge route extends northward to Pagosa Springs on the south side of the range. A spur on the north side serves Lake City. The only standard gauge road entering the mountains extends from Alamosa to Creede. A standard gauge road connects Durango with Farmington, New Mexico, and another connects Montrose with Grande Junction.

Wagon roads were constructed very early by those interested in the mining enterprises, and later by ranchmen. More recently, through county and state coöperation, an excellent series of automobile highways has been completed, and others are under construction. The range can now be crossed at several places by automobile with comfort and ease. The highway which follows the Rio Grande from the east and turns up the South Fork Valley to Wolf Creek Pass leads through a beautiful portion of the mountain area over to Pagosa Springs. The route continues through the foothill belt to Durango then turns northward, following the valley of the Animas for a time, passing through the canyon area until Silverton is reached. The route from Silverton to Ouray is

FIGURE 19.—Cliff palace, home of the ancient cliff dwellers in the Mesa Verde National Park. The cliff dwellers were the earliest known inhabitants of the San Juan region.

open and it is an excellent mountain road through a magnificent bit of mountain scenery. The road up the Rio Grande to Creede and thence on farther upstream and over to Lake City and down the Lake Fork to the Gunnison is also an attractive auto route. From Sapinero, on the Gunnison, one may turn westward and follow along the rim of the Black Canyon of the Gunnison, or eastward, and passing the city of Gunnison, continue upstream and over the Sawatch range by way of Monarch Pass. From Durango a good auto route now leads to the summit of the Mesa Verde, and thence to the famous homes of the ancient cliff dwellers of the Mesa Verde National Park.

Trails.—Those who would abandon railroad trains and automobiles find still greater treats by following the trails through the high mountain areas. One of the most notable scenic trails in America follows the continental divide from a point near Cumbras in the southeastern portion of the mountain area northwesterly to a point near Silverton, and from that point so many other excellent trails are available, that the entire mountain area may be viewed from the skyline. No region in the San Juan offers any more attractive mountain scenery or more attractive camping places or better fishing than these routes far from the common highways.

One may go to the very base of the Rio Grande pyramid in the saddle, or into the heart of the Needles with his pack train. It is possible to come within three thousand feet of the summit of Mount Sneffels in the saddle, and with a good horse one may reach within a thousand feet of the summit of Mount Uncompahgre, 14,306 feet above sea level.

Travel in the saddle and with an accompanying pack train is possible through many portions of the range where trails have been built, but it should not be undertaken by any who are not experienced in the care of stock in high mountain areas. The topographic maps of the United States Geological Survey, if carefully interpreted, help in laying out routes through the mountains. The service of the forest rangers should be sought by those unacquainted with the higher trails, or unaccustomed to the responsibility of leading parties through such rugged mountains.

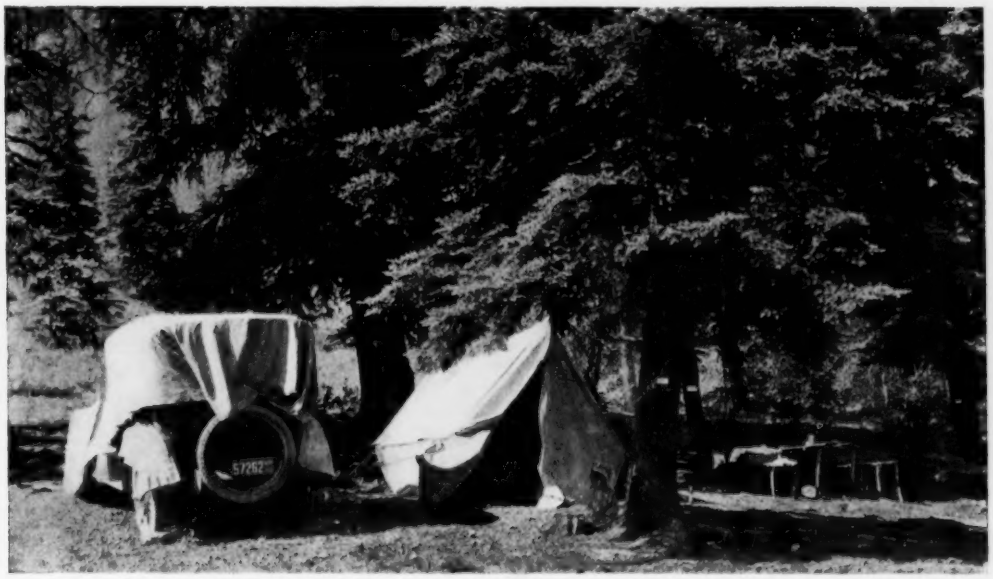

FIGURE 20.—Camping in the Cochetopah National Forest.

CONCLUSION

The individual actors in this great human drama have all had their entrances and many their "exits." Each generation, perhaps unconsciously, but necessarily, is adjusting itself to the physical, social, and economic environment. Prospectors will undoubtedly continue to search these mountain slopes, miners will work farther and farther underground for the ores within them, and ranchmen and farmers will use the lowlands and the high summer pastures.

As the pressure of population is felt more keenly lower grade ores may be mined and less attractive lands may be pressed into service for ranches or farms. More herdsmen and shepherds will apply for grazing permits. Lumbermen will be willing to go farther into the range and higher on the slopes. Cut-over lands and burned areas should be reforested for this is naturally a forest-producing area, and scientific care of the trees will assure a large permanent supply of timber throughout this mountain region.

The scenic beauty and recreational features of the range will undoubtedly lead to a larger and larger summer population; and in time the preparation for and the care of tourists may become one of the leading occupations of the residents of this mountain country.

Like all lofty and rugged mountain regions of the world, the San Juan region furnishes striking examples of the influence of geographic conditions upon routes of travel, the locations of settlements, human occupations, and the ultimate utilization of the natural resources within such regions; its physical features set it off conspicuously from the surrounding lands; its climates are local and notably affected by the general elevation of the area; its soils vary chiefly with topographic location; its flora reflects the influences of topography, altitude, rainfall, and soils; the latitude, the altitude, and the situation of the range determine the length of the local growing season. No satisfactory economic study of such a region may be undertaken without an appreciation of its physical geography.

BRITISH COLONIAL COMPETITION FOR THE AMERICAN COTTON BELT *

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THERE has been during recent years some concern about the possibility of the United States losing its supremacy as a cotton-growing country. Some fear was expressed that this might yet turn out to be the case. Reassuring reports were issued a few years ago by both the United States Department of Agriculture and the Chamber of Commerce of the United States that our Southland was in very little danger of losing its supremacy. The fear had been based very largely upon the succession of small crops raised during the seasons of 1921–1922 to 1923–1924. Since then we have had a normal crop and two bumper crops. The fear aroused by that period of small crops has disappeared and today the South is again asked to consider the carrying out of steps which might lead to a condition similar to that of 1921 to 1923. Consistency in growing bumper crops of cotton may be a jewel for the South but not when public men attempt to guide the grower of cotton.

We are neither in any immediate, nor for that matter any remote, danger of losing the position we now hold as the leading producer of that great staple, cotton. But we do not any longer occupy, in the sense of that complete overshadowing of our competitors, the place that was once ours. At one time we produced as much as 90 per cent of the world's commercial crop. Today we produce less than 60 per cent when we have a bumper crop and in the short crop year of 1921–1922 we produced only 50 per cent of the world's commercial crop. Since 1920 the extension of cotton growing and the plans made for further extension in other lands have so far progressed as to give rise to the belief that the next short crop will see our share of the world's crop go below 50 per cent. As a matter of fact had our crop of the season 1921–1922 been grown in the year 1924–1925 it would have earned us credit for raising only 40 per cent of the world's cotton crop for that year.

The rather sharp drop of recent years in our share of the total world crop is illustrated by Table I and Figure 1 based thereon. This table was compiled by John A. Todd of Liverpool, England, who is today one of the outstanding authorities on world cotton crops, and appeared in the *Empire Cotton Growing Review* issue of April, 1926. It will be noticed from this table that while the United States increased its crop between the years 1902 and 1926 about 6,300,000 bales or 58 per cent the total world crop increased 13,000,000 bales during this same period, an increase of about 75 per cent. Further it will be noted that a large part of this world increase has taken place in British Dominions and Protectorates. If there is anything disturbing in this record of growth of the cotton crop in other countries, it lies not so much in what has already been accomplished, but in the plans for the future to extend this accomplishment until a real threat does confront the cotton farmer of the South.

The cotton manufacturing industry in Great Britain is the dynamic force behind this movement to grow cotton in other lands and more particularly in British Colonies. There are some very

* The author's thanks are due to the officials of the British Cotton Growing Association and the Empire Cotton Growing Corporation for placing at his disposal much of the data available in their files and for interviews courteously extended.

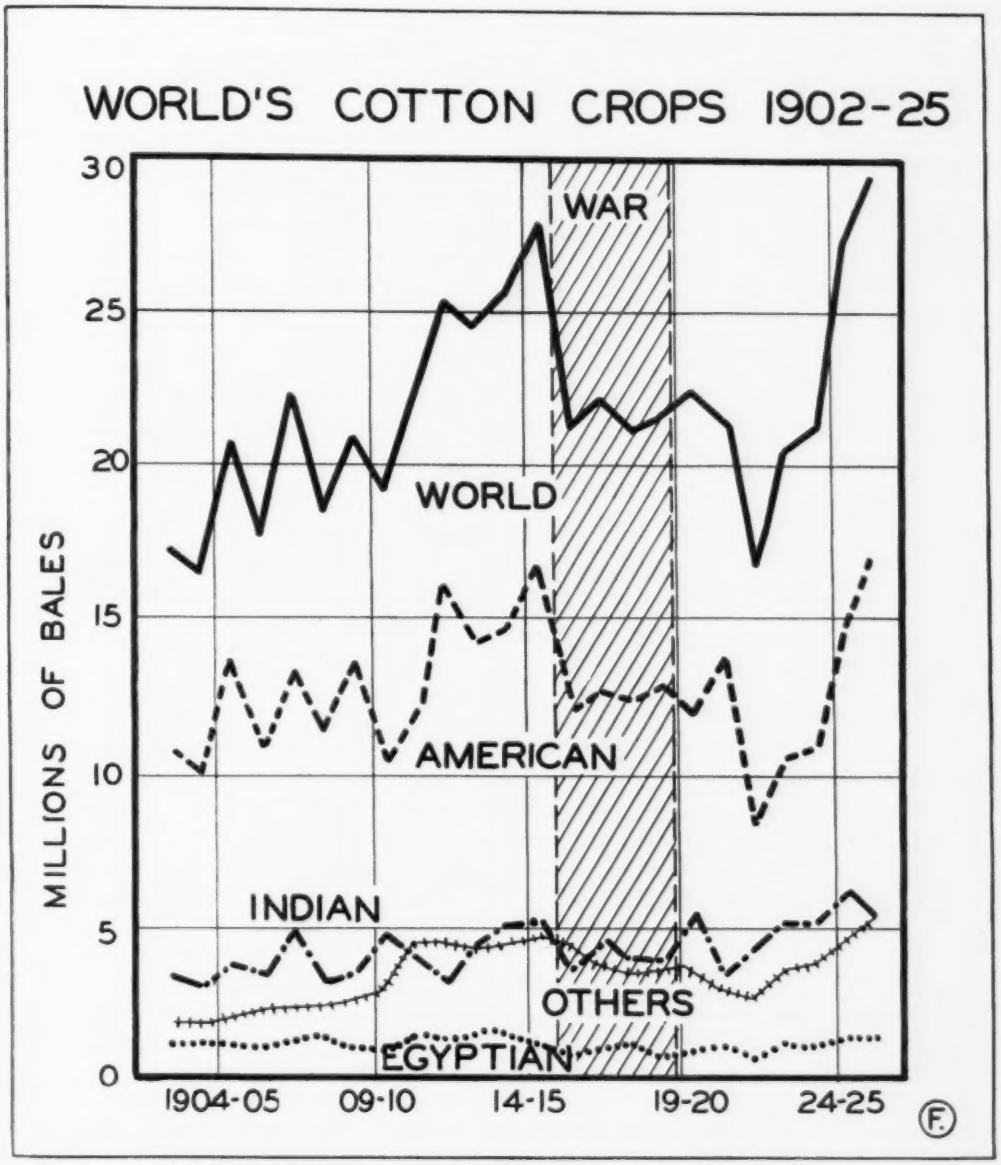

FIGURE 1.—That the American crop dominates the world's supply and the world's prices can clearly be inferred from this chart. The competing regions have a long way to go before they threaten the supremacy of American cotton.

sound reasons for this. The Civil War in the United States during 1861 to 1865 practically cut off the English industry's supply of raw cotton, and almost resulted in the fulfillment of Senator Hammond's prophecy, should England's cotton supply be cut off that "England would topple headlong and carry the whole civilized world with her." [1] Since then Great Britain has encouraged the growth of cotton in other lands. The cotton industry is very important to England; our Civil War taught her that she could not afford to depend on only one source for the necessary raw material.

[1] From the speech of Senator J. H. Hammond in United States Senate, March 4, 1858.

Cotton like all agricultural products is subject to the vagaries of the weather, the devastation of plant diseases, and the depredations of insect pests. The ups and downs shown on the chart (Figure 1) disclose in a measure to what extent the crop is affected from year to year by these causes. Hugh B. and Lucy W. Killough in their study[2] of factors entering into the price of cotton show how the price of cotton varies with the size of the crop. Figure 2 showing world crops and average quarterly prices of American cotton clearly shows the same phenomenon — a variation particularly pronounced since 1914 because of the abnormal conditions due to the World War. The English cotton industry has complained bitterly of these price fluctuations which they ascribe to the changes in size of the United States crops and to speculators in United States cotton markets. This furnished them with an added reason for their effort to grow cotton elsewhere than in the United States.

Great Britain discovered some years ago that cotton could be grown successfully in various parts of Africa. To the other two reasons previously mentioned there has now been added this further great reason which is probably destined to overshadow the others: The growing of cotton in Africa may be the means of helping her colonies there reach, in a comparatively short time as national life is measured, a stage in their development which otherwise might take a century. This development would also mean large markets for British products resulting in a mutually beneficial effect. This reason, development of her colonies, is now the one which is stressed when funds are requested for new railways, extension of port facilities, and the other developments necessary when backward countries are in process toward a more advanced civilization.

These are sound reasons for developing one's own supply of raw material and we cannot quarrel with Great Britain. But we should have an acquaintance with what is being done in this direction and measure, if at all possible, the effect

TABLE I

THE WORLD'S COTTON CROPS, 1903–1925

Bales of 500 lbs. (approximately). 000's omitted. Linters included in American Crop. Estimates in italic figures

Year	*America*	*Per Cent of World Total*	*India**	*Egypt*	*Russia*	*China*	*Others*	*Total*	*Per Cent on 1914*
1903–04	10,016	61	3,161	1,302	477	800	751	16,507	60
1904–05	13,697	66	3,791	1,262	536	756	803	20,846	75
1905–06	10,726	61	3,416	1,192	604	788	938	17,664	63
1906–07	13,305	60	4,934	1,390	759	806	1,027	22,221	80
1907–08	11,326	62	3,122	1,447	664	875	950	18,384	66
1908–09	13,432	64	3,692	1,150	685	1,000	971	20,930	75
1909–10	10,386	54	4,719	1,000	663	1,419	950	19,137	69
1910–11	11,966	55	3,889	1,515	879	2,589	968	21,806	78
1911–12	16,109	64	3,288	1,485	859	2,552	1,058	25,351	91
1912–13	14,091	57	4,610	1,507	883	2,298	1,160	24,549	88
1913–14	14,614	57	5,066	1,537	980	2,303	1,287	25,787	92
1914–15	16,738	60	5,209	1,298	1,157	2,363	1,154	27,919	100
1915–16	12,013	57	3,738	961	1,402	2,057	984	21,155	76
1916–17	12,664	57	4,489	1,022	1,105	1,714	1,027	22,021	79
1917–18	12,345	58	4,000	1,262	603	1,836	1,086	21,132	76
1918–19	12,817	59	3,972	964	420	2,084	1,296	21,553	77
1919–20	11,921	53	5,796	1,114	246	1,968	1,483	22,528	81
1920–21	13,700	64	3,600	1,206	116	1,373	1,471	21,466	77
1921–22	8,360	50	4,485	972	52	1,364	1,440	16,673	60
1922–23	10,320	51	5,073	1,243	52	2,022	1,603	20,313	73
1923–24	10,811	51	5,162	1,306	295	1,785	1,871	21,230	76
1924–25	14,497	54	6,141	1,455	450	1,976	2,325	26,844	96
1925–26†	*17,100*	*56*	*6,038*	*1,600*	*927*	*2,068*	*2,500*	*30,233*	*108*

* 400 lb. bales. † Year 1925–26 estimated.

[2] *Journal of the American Statistical Association*, March, 1926.

that this action is likely to have on our own welfare.

In this paper we shall discuss principally Great Britain's contribution to the growth of cotton inasmuch as Great Britain has been following a consistent policy involving great effort and the expenditure of large sums of money for many years and there is every promise that eventually there will be a full fruition of her plans which may have some startling effects.

On May 7, 1902, the British Cotton Growing Association was formed because of the belief held by the British cotton industry that "suitable cotton for the Lancashire trade could be grown in various parts of the British Empire." This association was to make inquiries as to where cotton could be grown and to carry on a small amount of experimental and missionary work. Before long it was discovered that the association would have to extend its activities to supervise the entire industry of growing cotton in Africa and other parts of the British Empire and actually buy and gin cotton. In August, 1904, the association was reconstituted with a paid-up capital of four hundred and seventy-one thousand pounds sterling. The work of the association since then has consisted of inquiry, experiment, and development. The periods of inquiry and experiment are over, but not before the association had inquired and experimented in every part of the British Empire where cotton could possibly be produced. Now the association is engaged in development work which consists principally of the following:

Educational work to improve the quality of cotton and increase the yield of lint per acre.

Establishing ginneries.

Establishing experimental farms.

Buying cotton and guaranteeing prices in the regions where the association is fostering cotton growing.

Developing a demand for Empire grown cotton in Lancashire.

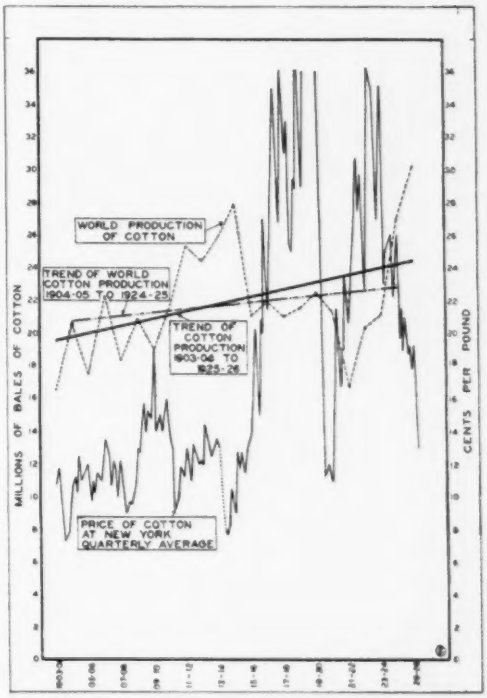

FIGURE 2.—The chart is self-explanatory, and indicates the relation of production and price to trend of production.

The educational work consists of working with the governments of the various colonies to improve and strengthen the departments of agriculture and then with and through these strengthened departments to find varieties of cotton which will grow well under the soil and climatic conditions of each section; distributing the right kind of seed; teaching and encouraging the natives to grow the largest possible crops.

The experimental farms are established in connection with the educational work to develop the best varieties of cotton for each region; to grow seed for distribution among the natives for each season's planting, and to act as model farms to show the native farmer the most advantageous cotton farming methods.

Cotton has been grown in Africa for a long time by the natives and woven into cloth. Until the British Cotton Growing Association established ginneries, this cotton was ginned by hand. Now the association establishes ginneries wherever

there is a good possibility of a fair-sized cotton crop being grown to encourage the native farmer to carry on. The establishing of a ginnery involves the setting up of buildings and the supplying of machinery and stores. During 1925 the buildings, machinery, and stores supplied had a value of one hundred and seventy thousand seven hundred and eighty-three pounds sterling, which gives some idea of the extent of this association's activities to bring to a full realization the hopes with which the association was founded, to supply the entire needs of the English cotton industry with Empire grown cotton.

The last of the association's activities is that of buying cotton and developing a market for it in Lancashire. Very soon after operations in Africa had begun, the association found that the native cotton grower needed some price protection if he was to be properly encouraged to produce cotton rather than some other crop. Africa was a new venture in cotton growing with no assurance that the cotton would be of a kind that could find a ready market. Commercial cotton must be of a type that will fit in with the delicately adjusted machinery of the cotton mill. The association by guaranteeing a market for the grower solved the problem and assured to the grower a fair price.

The accompanying pictures, illustrating what is being done by the association for the benefit of the natives growing cotton, are published through the courtesy of the British Cotton Growing Association. Operations such as these are conducted in India, the Sudan, Nigeria, Uganda, Rhodesia, Iraq, and Nyasaland.

With the limited resources at its disposal the association again discovered that it could not, within a reasonable period of time, conquer continents for cotton cultivation. The necessity continued, however, and so an appeal was made to the British Government for help. The result was the appointment of the Empire Cotton

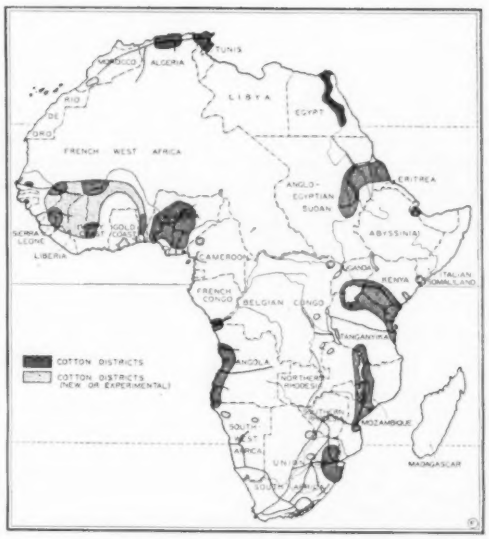

FIGURE 3.—The actual potential cotton producing areas of Africa indicate that with favorable conditions the cotton production of Africa may in time become a serious competitor of the American crop. (Adapted from *Commerce Monthly*, —National Bank of Commerce, New York.)

Growing Committee by the Board of Trade "to investigate the best means of developing the growing of cotton within the Empire and to advise the government as to the necessary measures to be taken." This committee in turn made an exhaustive study of areas where cotton is being grown and new or experimental regions where the indications pointed to a possibility of successful cotton growing. The accompanying sketch map of the world prepared for the committee shows these regions. It will be observed from this map that there appear to be large areas of definitely proven land in Africa on which cotton can be grown. Until now only small quantities have been produced but the possibilities seem to be great and English hopes are high. For example, take Egypt and note the small area devoted to cotton. This area is now producing more than 1,500,000 bales of 500 pounds each and competent engineers believe that by proper drainage in the Delta region, accompanied by irrigation, this region can easily produce over 2,000,000 bales. Consider also the Sudan region. The area of proven cot-

ton land is much greater here, but because of the small area under cultivation only about 100,000 bales of 400 pounds each are now produced. Add to Sudan the other regions of which only small areas are under cultivation and there seems to be reason enough for high hopes. We shall presently examine these regions in some detail.

The result of the report of the Empire

3. Loan the services of men long experienced in cotton growing to the various local governments in proved cotton growing regions.
4. Establish and maintain research work in this field of cotton growing.
5. Collect and disseminate knowledge of all matters of interest in this field.

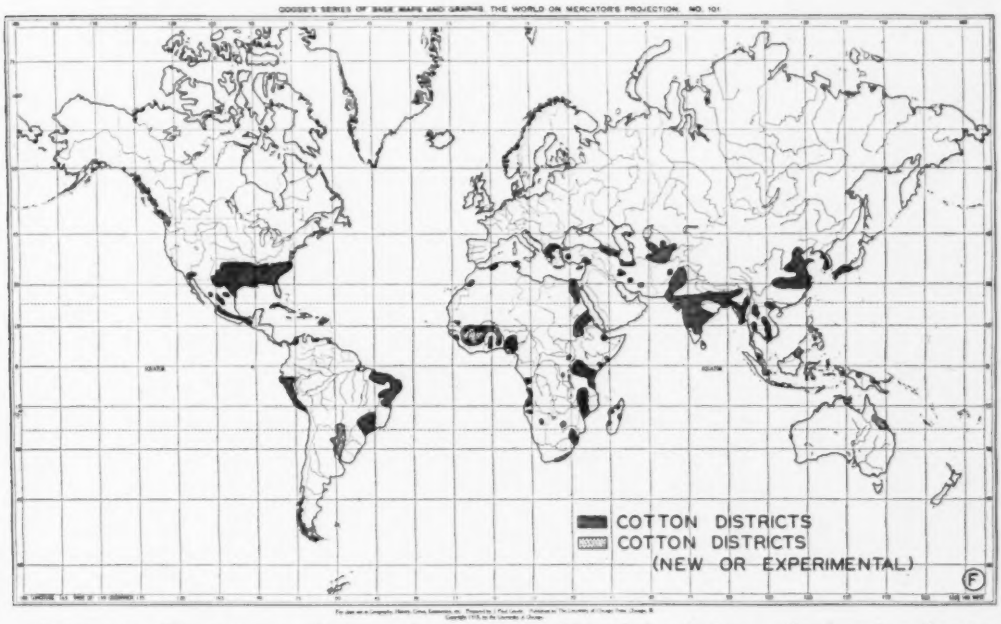

FIGURE 4.—The cotton producing regions of the world in their relation to the American "cotton belt" are strikingly presented in this map. That some of the regions will be considerably extended when conditions are better known is most certain.

Cotton Growing Committee was the formation in 1920 of the Empire Cotton Growing Corporation, to

1. Encourage and assist in the training of men for employment in the agricultural departments of the colonies and protectorates to enable them to deal with the specific problem of cotton cultivation.
2. Make grants to local agricultural departments to enlarge their staffs in order to permit of the employment of such specially trained men.

This short résumé of what the British Cotton Growing Association and the British Empire Cotton Growing Corporation set out to do and which each in its field is successfully accomplishing is sufficient indication of (1) The seriousness with which the British cotton industry and Government look upon the need for Empire grown cotton and, (2) That having put the hand to the plow and turned over a furrow, we can expect England with her characteristic doggedness to carry the task through to a finish.

Let us consider now in greater detail each of the regions where it is hoped the

efforts of these two organizations will secure results commensurate with their activities.

INDIA

Cotton has been grown and woven into cloth on a large scale in India for a long time. In fact less than two hundred years ago Indian cotton cloths were an important article of world commerce. Practically all the cotton cloths imported into England prior to that time came from India. The inventions in cotton manufacturing machinery in England beginning about two hundred years ago combined with the invention of the cotton gin and the extensive growth of cotton in the United States caused India to almost pass from the scene of world commerce in cotton and cotton fabrics. From the position of principal exporter of cotton cloths she has finally dropped to the position of the largest importer of cotton cloths. The cotton industry grew amazingly in England and when the Civil War in the United States shut off her imports of cotton lint, the English industry had to shut down. This was a calamity and England determined to try to free herself from depending altogether on the United States for certain kinds of cotton lint. India was turned to because of her experience as a cotton-growing country. The cotton-growing industry was encouraged. To observe the results of this encouragement we do not need to go back more than twenty-five or thirty years, as the following table shows the growth that has taken place in India during that time.

Year	*Acreage Planted to Cotton 000's omitted**	*Cotton Production 500 lb. Bales 000's omitted†*
1897	13,683	2,122
1900	14,231	2,162
1905	20,401	3,389
1910	22,596	3,082
1915	17,967	3,055
1920	23,352	4,637
1925	26,461	5,910

* Nearly 100% increase in acreage.
† Nearly 200% increase in cotton lint.

While the climate is such that cotton can be grown almost throughout the entire area, most people imagine that because of India's population of about 325,000,000, it is a crowded country offering almost no opportunity for the further extension of cotton growing. There are, however, in the northwest of India large regions of arid land in the Punjab and Sind States which when properly irrigated are believed to be capable of producing, along with other crops, a good grade of American cotton showing a high yield per acre. The Punjab now has nearly 13,000,000 acres of irrigated land under cultivation and it is proposed to presently increase this area. Eventually it is hoped the area may reach 20,000,000 acres in this state alone. Plans were laid in 1920 to construct what is known as the Sukkur Scheme. The Sukkur Barrage, part of this scheme, is now in process of construction with the prospect of being completed by 1930. This will add several million acres to the Sutlej Valley

FIGURE 5.—Purchasing cotton at the association buying store at Baghdad. Mesopotamia bids fair to resume her old place of power and prominence in the trade of the world. (Courtesy of British Cotton Growing Association.)

of which about one million acres should be suitable and available for growing American types of cotton. In the Sind the Lloyd Barrage on the Indus is under construction. When this is finished an area equal to the area under cultivation in Egypt will be added to the present cultivable area. This will permit about 750,000 additional acres to be planted to American types of cotton. With further provision for irrigation additional land is available and can be brought under cultivation.

Important as these various schemes are perhaps the most valuable efforts to improve cotton growing now under way in India are those of the Indian Central Cotton Committee. This body was formed some years ago to try to do for India what the Empire Cotton Growing Corporation is trying to do for the British Empire. This committee working through the agricultural research institute is trying to improve the quality and yield of lint, improve the agricultural methods of the native farmer, and improve the methods of marketing. This the committee is doing with some success. The season of 1915–1916 saw 2,471,000 bales of 400 pounds each under 7/8 inch staple cotton and 1,267,000 bales of 7/8 inch and over staple produced. Improvement continued from year to year and in the season of 1925–1926 there were produced 3,346,000 bales of 400 pounds each under 7/8 inch staple and 2,692,000 bales of 7/8 inch and over staple, an increase of considerably more than 100 per cent in the growth of the longer staple better-grade cottons in eleven years.

Competent authorities in the British cotton industry believe that in another ten years India will be producing at least 8,000,000 bales of cotton of which fifty per cent will be of a staple 7/8 inch and over of American types of cotton, the quality which is used to a great extent in European and American cotton mills. There are of course tremendous difficulties to be overcome in the production of the longer staple cotton partly because of the climate which permits of only a short growing season. Through the efforts of the Indian Cotton Growing Committee and the British Cotton Growing Association these difficulties are gradually being overcome through the development of early maturing seed from which can be grown the kinds of cotton desired.

FIGURE 6.—The ginning factory on the estate of the B. C. G. A. (Punjab), Ltd., at Khanewal, Punjab. This view might well be from the plains of Texas or the delta country of the Mississippi. (Courtesy of British Cotton Growing Association.)

AFRICA

Egypt comes first to mind because of her long history as a settled, highly civilized, well-cultivated country and her present importance in cotton production. Egypt produces a special type of cotton, possessing a long silky, creamy colored lint suitable for the spinning of

very fine counts of yarn and when woven into very fine cotton fabrics partakes of the appearance of silk. This cotton is in great demand in England where most progress has been made in the production of fine cotton cloths. This fine cotton lint, generally known as *Sakellaridis*, sells usually at a substantial premium over the American-grown cottons of good grades.

Egypt is a large country, over 350,000 square miles in area; unfortunately, however, most of the country is desert. Its cultivable area is confined to the Delta and a narrow strip along the sides of the Nile. There is so very little rainfall in Egypt that cultivation must depend upon irrigation, consequently the area under cultivation is limited by the area which can be irrigated by the waters of the Nile. This limited area of about 7,000,000 acres must also supply the food-stuffs required by an ever increasing population. For the season 1925–1926 about 1,900,000 feddans[3] were planted to cotton and the yield was about 1,600,000 bales of about 500 pounds each. The excellent soil, unsurpassed climate, and a sufficient supply of farm labor makes possible a large yield per feddan. Egypt seems to have reached her limit as a producer of cotton unless she is able to carry into effect the scheme already determined upon, "to remedy the unsatisfactory condition of parts of the Delta as regards drainage and the control of excess water." Most of the cotton is grown in the Delta region. This region is divided into three zones. The upper or south end of the Delta stands fairly high and has not suffered much from waterlogging. A few years ago the middle zone suffered much from waterlogging but the northern zone has for centuries been waterlogged and the soil has become so salted as to be waste land. Egypt proposes to properly drain the central and northern zones and reclaim the land. Since her population is growing at the rate of 200,000 yearly, this seems necessary. It is estimated that the completion of the proposed scheme will add sufficient cultivable land to permit of adding about 700,000 bales to Egypt's present crop. The cost of this scheme including the arrangements for the necessary irrigation and storage works will be close to $200,000,000. The immensity of these projects and the willingness to undertake them is certainly a source of wonder.

FIGURE 7.—The reservoir on the Nile in connection with the pumping scheme at Wad-el-nau, for small scale irrigation of the rich valley lands. (Courtesy of British Cotton Growing Association.)

The Anglo-Egyptian Sudan immediately south of Egypt, and which is believed by the British Cotton Growing Association to hold out the fairest hopes for Empire-grown cotton must be considered in conjunction with Egypt. The present proven areas of this country lie in the region of arid lands requiring irrigation from the waters of the Nile. Egypt has first call on the waters of the Nile and she is apprehensive of her future when schemes are proposed to irrigate other extensive regions from the same stream. Those interested in growing cotton in the Sudan agree that Egypt must be taken care of first since it would be nonsensical to destroy Egypt as a cotton producer to develop a land still in the experimental stage.

Sudan

Why is the Sudan looked upon as so fair a prospect? The Sudan has an area of about 1,000,000 square miles. The northern part like Egypt is practically rainless. The middle belt running through Port Sudan and Khartoum has

[3] A feddan is about equal to an acre.

FIGURE 8.—Women ginning cotton by very primitive methods near River Rahad, Kassala Province, Sudan, a reminder of American production before the genius of Eli Whitney produced the cotton gin. (Courtesy of British Cotton Growing Association.)

a rainfall of four to eight inches. The southern belt beginning at Sennar lies almost wholly within the region of tropical rainfall in Central Africa. The rainfall ranges between twenty and fifty inches in this southern belt. This gives a vast region capable of producing rain-grown cotton. For the present not much attention is being given to this region because of other larger and more promising sections. The most important of these is the large tract of land south of Khartoum between the White and Blue Niles known as the Gezira Plain. This tract has an area of about 3,000,000 acres all of which can be irrigated. This plain is almost flat with a slight slope in the direction of the White Nile presenting an easy problem for both irrigation and drainage. The soil is a rich alluvial black clay about eight feet deep and quite uniform in character. It is proposed to irrigate this plain and the first step has been the completion of the Makwar Barrage at Sennar. The storage provided by this dam together with the main canal and the distributing canals will irrigate about 1,000,000 acres of this plain. At the present time because of the necessity of straightening out the difficulties raised by Egypt respecting her claims on the waters of the Nile, only 300,000 acres will be irrigated, 100,000 acres each year, the others remaining fallow. It is hoped that soon Egypt can be reassured as to her water supply and the full 1,000,000 acres irrigated. This will permit of growing cotton on 300,000 acres annually. Eventually the way out is expected to be found to irrigate the whole 3,000,000 acres of the Gezira Plain.

There are two other sections of the Sudan in which cotton growing has been proved to the extent necessary to warrant proposing plans for control of rivers which will permit of sufficient irrigation to make possible the growing of cotton on an additional 200,000 acres. These two sections are known as the Tokar and Kassala areas.

Then there remains the very large area in which rain-grown cotton can eventually be produced on a large scale. At present natives are growing cotton in this region in sufficient quantity and of good quality to warrant the belief that the soil and climate are satisfactory over large sections of this area. Means of transport at present are so poor that cotton must sell at a high price to pay the laborer for his effort. For example, the native in this region received about three cents a pound for his seed cotton when cotton lint sold on the New York Exchange for twenty to twenty-five cents a pound. At today's price the native might get one cent a pound for his seed cotton or about four cents for a pound of lint.

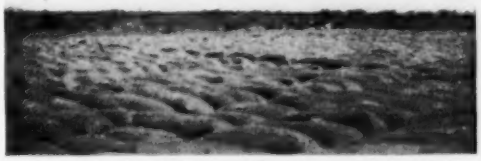

FIGURE 9.—Cotton collecting station in the Sudan. Favorable climatic conditions are indicated by this careless exposure to the weather. (Courtesy of British Cotton Growing Association.)

The extent of the possibilities of the

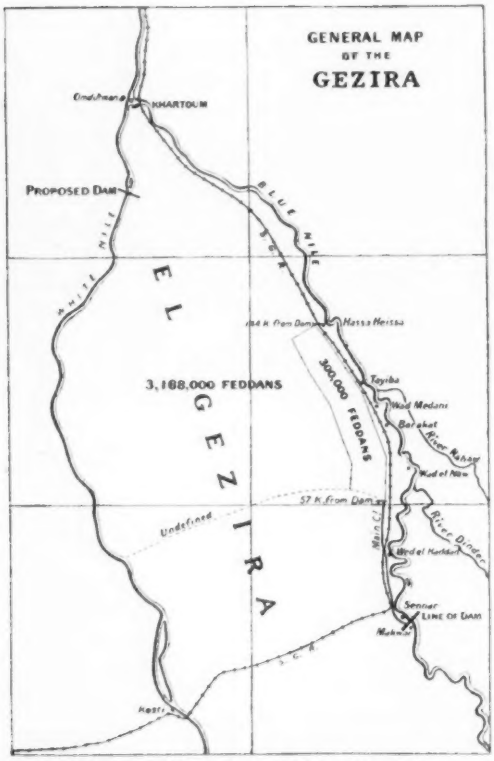

FIGURE 10.—The Gezira bids fair to become one of the great cotton producing regions of the world. It is likely that the supply of water for irrigation will control the area planted in cotton. (Courtesy of British Cotton Growing Association.)

Sudan may be glimpsed by a look at the map. The Gezira Plain of 3,000,000 acres is the small triangle with Khartoum at the apex, the Blue and White Niles the sides, and the base a line drawn from Sennar to Kosti. And the transportation problems can be sensed by a study of the existing and proposed railways. The Sudan also has somewhat of a population problem to deal with inasmuch as the population is estimated at a little more than 5,000,000 persons. These 5,000,000 scattered all over this vast region of 1,000,000 square miles engaged in varied occupations or none at all would make necessary considerable colonization to grow any very large quantity of cotton in the Sudan.

Uganda

From the viewpoint of results so far obtained, Uganda is the fairest prospect of all the new areas devoted to cotton in the African possessions of the British Empire. As a matter of fact the 1924–1925 crop of Uganda exceeded the crops of all the other African colonies put together. Uganda has an area of about 100,000 square miles of which about 16,000 square miles are under water. The soil and climatic conditions are regarded as very good for cotton. The cotton is rain grown. Although of recent origin, cotton growing has made good progress and has out-stripped the transportation facilities of the country so that further extension of cotton growing will not be profitable until transportation facilities have caught up with the present cotton-growing sections.[4] There are districts which are only waiting for transportation to be opened up to cotton growing and just as this occurs there may be a further rapid increase in the size of the crop. The population of Uganda is about 3,000,000 persons and is said not to be kindly disposed toward systematic labor. This difficulty along with the competition of other crops will probably prevent the fulfillment of the very optimistic hopes held out for this region, that of growing an annual crop of 500,000 bales of cotton within a reasonable time.

Nigeria

Next to the Sudan the British Colony of Nigeria is looked upon as holding out the best hope of eventually growing large crops of cotton. Nigeria is one of the largest of British tropical possessions with an area estimated at about 367,000 square miles. The population of Nigeria is estimated at approximately 18,000,000 and is composed mostly of good farmers. Cotton, it is believed, can be grown in nearly all parts of this country either as a rain-grown crop or by means of irrigation, in the Lake Chad region particu-

[4] See the Articles in the *Commerce Monthly* of the National Bank of Commerce, New York, and "Africa — Its Cotton and Its Railroads" and "Trade Connections in Tropical Africa" by W. H. Barker in ECONOMIC GEOGRAPHY, October, 1925, and the accompanying map, courtesy of National Bank of Commerce.

FIGURE 11.—Bales of cotton awaiting transport at the pier at Jinja, Uganda. Recently loans have been guaranteed to permit greater extension of railway and other transportation of cotton production.

larly. This irrigation, it is believed, could easily be provided for by the annual rise of the lake. This annual rise now inundates a region around the lake five to ten miles deep and about 150 miles in length. Making allowances for food crops and some tropical and forest crops which can be profitably raised for export, it is estimated that probably discouraging task when yields are as small as those in Nigeria.

Like nearly all of Africa the transportation problem needs solving if any further important results are to be obtained. Nigeria possesses 1,250 miles of railways or three and one-half miles of railway per 1,000 square miles of territory. There are, of course, several navigable

FIGURE 12.—Progress in Sierra Leone. Many of the roads in parts of Sierra Leone and Nigeria have been so improved by the natives that motor transportation is feasible, thus opening up great areas of potential cotton production to the markets of the world.

25,000,000 acres can be sown to cotton. Because of the present stage of agricultural development the yield of lint per acre is very small, the average being less than 100 pounds. Seasons of large crops in the United States with resulting low prices makes cotton growing a very rivers which provide additional means of transport, but large stretches must depend upon roads and motor transport, which is expensive transport for a cheap bulky product like cotton. Types of cotton and methods of agriculture must be greatly improved, along with an

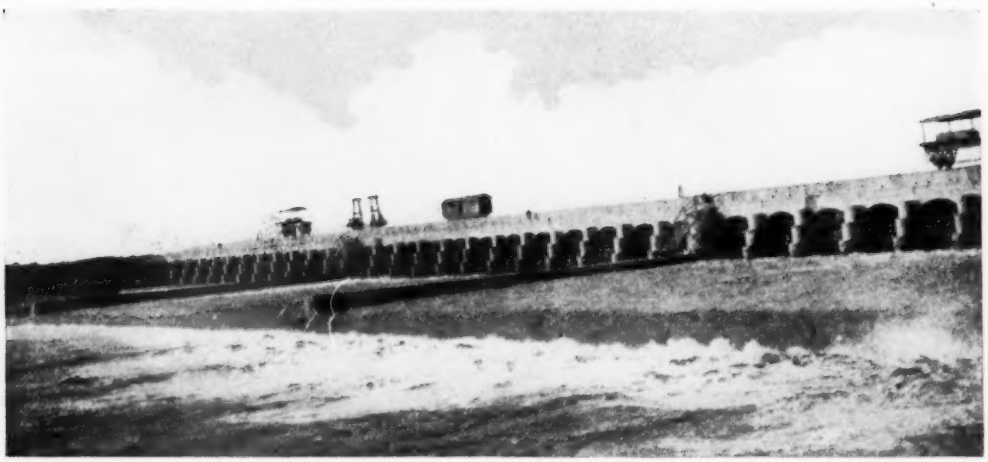

FIGURE 13.—The Hindiyah barrage in the Euphrates. Wherever British authority has been established in arid or semi-arid land, enlightened policies of irrigation, drainage and production of raw materials have been adopted and steadily carried out.

increase in cheap transport facilities if a worthwhile crop is to be grown.

IRAQ

Iraq (Mesopotamia) can next be considered. In this long strip of land following the lines of those two great rivers, the Tigris and Euphrates, studies have been made by the British Cotton Growing Association as to the possibilities of this country. As the result of these studies the facts have been established that soil and climatic conditions are suitable for growing cotton, but that it must be effected by irrigation. With proper irrigation and drainage, a larger population, cheaper and more direct transport facilities, and instruction of the natives together with the employment of scientific farming methods and modern machinery, about 1,000,000 acres would be available for cotton cultivation. Drainage in this country assumes most importance because of the salt content of the two rivers. Some damage has already been done to the land because of the instituting of irrigation without regard for proper drainage. To accomplish all of this, large expenditures of money and effort would have to be made. Some progress is being made in this area, but very slowly, and because of the factors already mentioned, coupled with some others of a political and social nature, not a great deal can be expected in the way of a commercial crop of cotton for a long time.

OTHER REGIONS

The regions so far described are the ones which have been chosen by the British Cotton Growing Association and the Empire Cotton Growing Corporation, as the result of their studies and experiments, as holding out the best hopes for large crops of Empire-grown cotton. There are other sections of Africa, such as North and South Rhodesia, South Africa, and Nyasaland, in which experiments have been made and some thousands of bales of cotton successfully grown. One authority [5] after extensive agricultural studies estimated that 4,000,000 acres were capable of growing cotton in South Africa alone. Experience has shown, however, that excessive rainfall, droughts, and a plethora of insect pests make it unlikely that South Africa will play nearly so large a part as the important regions detailed above.

There are some other places in the

[5] Sherflins & Wosthinzen—"Cotton in South Africa."

FIGURE 14.—Transporting cotton in Nyasaland. The great need of Africa for the extension of cotton growing is the expansion of the transportation policy and more railways to regions of potential production.

French,[6] Belgian,[7] and Portuguese Colonies in Africa where cotton is grown and, like the important British African cotton growing regions, given adequate transport, education, and encouragement of the natives in cotton cultivation assisted by irrigation where necessary, can probably grow larger crops. In fact, a strong movement is under way in both France and Belgium which has already culminated in the establishing of bodies similar to the British Cotton Growing Association to grow sufficient cotton in their African Colonies to make importations of American cotton unnecessary.

Those interested in the cotton growing industry in England are also encouraging cotton growing in South America.[8] Brazil grows even now a large crop, between 600,000 and 700,000 bales, and is believed to have an area as large as the United States cotton area suitable for growing cotton. Peru grows about 200,000 bales annually; Argentine grew 48,000 metric tons of seed cotton in season 1924–1925; in Mexico, Venezuela, Colombia, and in other countries cotton is grown in a small way. Europe grows some cotton and Russia has grown as much as 1,400,000 bales in one season.[9] This dwindled to almost nothing[10] but now is coming back in good measure, having grown an estimated crop of over 900,000 bales in the season 1925–1926.

FIGURE 15.—A cotton market in Nyasaland. From such primitive production as this the cotton industry of the British possessions may in time make the spindles and looms of Lancashire independent of American cotton.

[6] See reports in *L'Agronomie Coloniale, Bulletin Mensuel de l'Institut National d'Agronomie Coloniale.* See map in November, 1925, issue of above bulletin, which indicates the extent of the activities of l'Association Cotonnière, and how closely they follow the activities of the British Association.

[7] See reports of speech of General Meulemeester, formerly Vice-Governor of Belgian Congo, in International Cotton Bulletin, No. 16, before the Belgian Cotton Spinners Association on the enormous development possible in the Congo.

[8] See *International Cotton Bulletins* Nos. 14 and 16.

[9] 1915–1916.

[10] 52,000 bales in 1921–1922.

FIGURE 16.—Caravan of camels en route for Persia. Until railways are built across long desert stretches the camel promises to be the sole means of transportation of the cotton crop of many areas.

China is also a large producer, but reliable figures were never available, and with the present unrest in that country correct figures are even less available. China, however, must produce large quantities of cotton, and when settled conditions again return to that unhappy country, the large development in cotton manufacturing which has taken place during the past twenty years[11] will probably result in a movement to urge the producers to grow large crops of cotton.

This recital of what is being done by Great Britain to supply her most important industry with home-grown raw material, which now comes largely from the United States, is of some interest as information, but does not become a thing of life unless we draw conclusions which, on the basis of the evidence, seem reasonable.

The British Cotton Growing Association started its campaign in 1902 and starting at zero it has helped produce the results visualized on the chart (Figure 17). Considering that during the early years its work had to be altogether inquiry and experimental, and that just as the development work got under way the World War started, putting more or less of an effective damper on its activities, the association has accomplished much. Since the end of the war in 1918 the yield of cotton in East, Central, and South Africa, where development work has been largely concentrated, has increased nearly 1000 per cent, a record that one should be proud of, and that justifies high hopes. The foundations which have been laid go deep, the inquiry and experimental work has been thorough, and the development work is based on sound lines. When, in addition, we consider the reasons underlying the movement—the supplying of raw material to the most important manufacturing industry of England and the opening up of a continent—we can believe that the work will be carried on and in time show considerable progress.

Those who are close to this movement are probably unduly optimistic about the results hoped for. The following

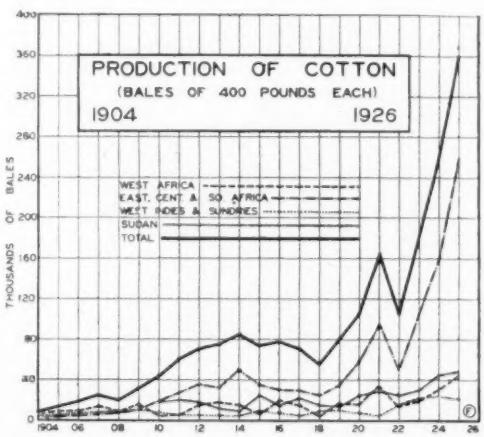

FIGURE 17.—A chart to show the production of cotton of some of the newly developed important cotton growing regions that are coming into competition with American cotton.

Table II, with a few corrections by the author to bring it up to date, was published a few years ago by the British Cotton Growing Association, and in-

[11] See "World Developments in the Cotton Industry," by the author.

TABLE II

COTTON GROWING WITHIN THE BRITISH EMPIRE

Colony of Protectorate	*Area Approximately Sq. Miles*	*Population Approximately*	*Suitability of Soil*	*Climatic Conditions*	*Methods of Transportation*	*Approximate Cotton Produced in 400 Lb. Bales*	*Quality*	*Possibilities of Increase* Bales	Remarks
Nigeria	336,000	18,000,000	Good over large areas especially in Northern Section	Good	Rail and River Niger	30,000	Fair in Southern Section, very good in Northern Section	1,000,000 (Minimum)	Extremely promising with improved rail and road transport in the Northern Section.
Uganda	100,000	3,000,000	Extremely good	Good	Rail, lake steamers and rail to port	175,000	Very good	500,000 (Minimum)	Steady progress anticipated at rate of 15 to 20 per cent annually.
Sudan	1,000,000	5,500,000	Excellent with irrigation	Very Favorable	Rail	100,000	Excellent	1,500,000 (Minimum)	Increase certain as irrigation is extended. Transport required to such districts as Kassala, Tokar, etc.
Nyasaland	40,000	1,217,000	Good	Good	Rail and river	7,000	Good	100,000	Outlook promising, with improved transport.
Mesopotamia	.....	1,500,000	Excellent with irrigation	Good	.....	3,500	Excellent	250,000 (Minimum)	Capable of large developments.
Rhodesia	440,000	1,654,000	Good	Good	Rail and river	30,000	Good	100,000	Cheaper and better transport essential to any great increase.
South Africa	795,000	6,000,000	Good in many districts	Favorable	Rail	25,000	Fair	100,000	Agricultural departments and cheap transport required.
West Indies	12,300	1,730,000	Extremely fertile	Very Favorable	.....	3,000	The best cotton that can be grown	10,000	Capable of small increase but area restricted.
India	1,803,000	325,000,000	Good in many districts	Good	Rail	6,000,000	Poor to fair	8,000,000	Measures essential to improve the quality. There are possibilities of growing a better quality in irrigated districts in the Punjab and Sind.

dicates at a glance their hopes of the results to be derived from the work they are now doing. It will be observed that the results so far actually obtained are far from the hoped for results. To attain the desired results Great Britain and her colonies must embark upon various schemes, and among these necessary measures may be mentioned:

1. Carrying into effect of gigantic schemes of irrigation.
2. Building of many thousands of miles of railways and motor roads.
3. Carrying out of extensive port improvements.
4. Engaging in a tremendous educational campaign, agricultural and otherwise, among the natives of Africa.
5. Carrying out of some fairly large schemes of colonization.
6. Developing of agricultural departments in her colonial governments adequately manned, with personnel in sufficient numbers and trained in science to carry out the agricultural educational work, and properly prepared to wage incessant war on the myriads of insect pests injurious to man, beast, and plant.
7. Developing of the social and political life of the African native to a much higher level than now existing.

Cotton in a wild state is found growing in many places having a tropical or semi-tropical climate, but when a commercial crop is desired cotton must be grown scientifically, the varieties which *just grow* can never become much of a commercial factor. For the commercial growing of cotton, soil of certain types is desirable. The soil needs to be well watered and well drained and for large yields per acre should be rich in lime. After suitable soil is found, then certain climatic conditions enter into the problem. Cotton needs an average temperature during the growing season of not less than 77 degrees, and a frostless period of about 200 days to arrive at proper maturity. A rainfall of between thirty to fifty inches spread over the year with more or less evenness is desirable. Too much rain rots the plant and droughty conditions are just as harmful in another direction. Every country growing cotton is afflicted with plant diseases and harmful insects. In tropical Africa where England plans large operations, insect pests and plant diseases are very troublesome. So far as soil [12] and climatic conditions are concerned, there have not been sufficient weather observations and soil examinations made to say, with any degree of exactitude, how large an area in the various countries mentioned is suitable for commercial growing of cotton.

A consideration of the soil and climatic conditions desirable for growing cotton and the rather meagre knowledge we have of such conditions in Africa along with the carrying out of the measures listed above, and competition from other crops, leads to the conclusion that Great Britain faces a task which will require a tremendous capital outlay and many years of devoted effort to carry it through to completion in order to realize the great hopes now entertained. We can expect at best a rather slow and orderly development of the necessary plans resulting in a more or less measured yearly growth in the cotton crop from these sources. Allowing for an ideal development of her plans we could perhaps reasonably expect over the next twenty-five years the following increase in cotton grown:

	From the Present	*To*
India	6,000,000 bales	8,000,000 bales
Egypt	1,600,000 "	2,000,000 "
Sudan	100,000 "	750,000 "
Uganda	200,000 "	350,000 "
Nigeria	30,000 "	300,000 "
Iraq	3,500 "	100,000 "
Rhodesia	30,000 "	60,000 "
Nyasaland	7,000 "	50,000 "
South Africa	25,000 "	50,000 "
	7,995,500 "	11,660,000 "

[12] "The Soils of Tropical Africa," E. M. Crowther in *Empire Cotton Growing Review*, January, 1925.

Since England uses about 4,000,000 bales of cotton annually this increase of about 3,700,000 bales in Empire-grown cotton would probably furnish enough additional cotton to enable the English industry to use nothing but Empire-grown cotton. Since the consumption of cotton by the English industry has steadily declined during the past fifteen years and cotton manufacture has steadily[13] increased in other countries, particularly England's best customers,[14] there is every indication that the English industry will not need more than 4,000,000 bales of cotton yearly during the period of this expected increase in growth of Empire-grown cotton.

The original urge to grow cotton within the Empire was created by (1) fluctuations in the price of cotton, (2) high prices for cotton during the past ten years due to the war and short crops, and (3) the belief that the United States' crops were definitely dwindling to the point where the world would eventually find itself short of cotton. Since then there has been added the need to develop her African colonies, which in recent years has been intensified by the necessity for greater trade and production to liquidate the war debts so bravely undertaken at a time when there was considerable question that this liquidation could be successfully carried out.

The first two of these reasons is sufficiently supported by Figure 2 showing the fluctuations in price and the extremely high points reached by prices since 1915 to warrant England's action. Fluctuations in price are naturally distasteful to a manufacturer, and especially to a manufacturer who sells, like England, most of his products in foreign markets. The foreign merchant, located far from his supplies, prefers, as a rule, a steady price over a reasonably long period of time so he may receive his purchases and dispose of them in an orderly fashion without probability of loss due to price fluctuations. During the past ten years prices have been unduly high and because of these prices the English manufacturers believe that consumption has fallen off due to the inability of the large native populations of Asia and Africa to use the quantities of cotton goods which they ought to be consuming. There is considerable reason to believe this but not to the extent the English manufacturer suggests.[15] The limits of this article prevent discussion of these latter points, except to make this observation: A study of Figure 2 shows that prices fluctuate quite consistently with the size of the crop. How sowing additional acreage to cotton with the probability of a resulting larger crop, but with no control over variations in size of crop, would prevent fluctuations in price is a mystery. Economic laws are generally too well known to permit of a widespread belief of this character. The excessive fluctuations and high prices prevailing during the last ten years, like those following the Civil War in the United States, were due to a special set of circumstances which occurring again can reasonably be expected to cause similar variations.

We are concerned in this paper with the third reason, that the world would within a decade or two find itself short of cotton for its normal requirements. What is the situation as to world production and consumption? Perhaps the most complete figures of production are those of John A. Todd appearing in Table I. There are some objections to Mr. Todd's figures. For example, he includes linters in his American crop figures, and he counts Indian bales of 400 pounds each as of equal importance with the other bales which are 500 pounds each. There are some reasons for doing this, but linters are used to only

[13] See article, "A Challenge to U. S. Cotton Farmers," by the author in *Textile World*, January 1, 1927, issue.

[14] "World Developments in the Cotton Industry," by the author.

[15] This is rather fully treated in "World Developments in the Cotton Industry," by the author.

a small extent in mill consumption, and giving the Indian cotton bale a value of 500 pounds is partly a matter of guesswork. Consequently the commercial crop of cotton available for known mill consumption is in all likelihood smaller by one-half to a million bales annually. However, Mr. Todd's figures are probably the most consistent for the period under consideration. Figure 2 shows the actual world production and the trend line for the period of 1903 to 1925. A comparison of this trend line with Figure 18 showing the actual spindles in place and the trend line for substantially the same period indicates a much sharper trend to the increase of spindles in place. In fact, if we leave out of consideration the crops of 1903–1904 and 1925–1926, and construct a new trend line as shown on Figure 2, we find a growth of less than 10 per cent in world production of cotton between 1904–1905 to 1924–1925 as against, roughly, an increase of 40 per cent in spindles during the same period, giving rise to a remarkable situation in the cotton industry of the world. Because of the increased demand for raw cotton due to this growth of the manufacturing industry and the failure of cotton production to keep up with this demand, prices rose rapidly and to very high points during the latter part of this period. The rapid increase in spindles took place in many countries and was partly at the expense of actual spindles already in place in the older cotton manufacturing regions such as England and the New England states. There was also, because of keen competition from the newer manufacturing countries, a turning to the manufacture of finer yarns in these two regions and during and since the World War many spindles were idle due to war operations and business depressions. The decreased consumption caused by the idle spindles and greatly increased world crops during the past two crop seasons has brought the price of cotton to pre-war levels.

Unfortunately there are no reliable figures of cotton consumption. The International Federation of Cotton Spinners and the United States Department of Agriculture both compile what figures they are able to secure of consumption in the various manufacturing countries. These are good as far as they go. Because of the difficulties involved in securing figures of consumption from all over the world these figures are apt to be very wide of actuality. To illustrate, if we take the compilation of the United States Department of Agriculture of world production and consumption for the years 1908 to 1923[16] we find that there has taken place a much larger consumption of cotton than production during this period. It is obvious that such compilations of figures are not sufficiently accurate for any worthwhile deductions. Under the present circumstances we cannot know what is actually being consumed, the best we can do is to make a crude deduction of what could be consumed annually, under conditions of full-time

Year	*World Production of Cotton Seasons 1903–04 to 1925–26 from figures compiled by John A. Todd 000's Omitted*	*World Spindles in Place Years 1902–26* 000's Omitted*
1902	.....	111,800†
1903–04	16,500	
1904–05	20,800	114,400†
1905–06	17,700	
1906–07	22,200	120,200
1907–08	18,400	
1908–09	20,900	130,000
1909–10	19,100	
1910–11	21,800	134,600
1911–12	25,400	
1912–13	24,500	141,000
1913–14	25,800	
1914–15	27,900	146,400
1915–16	21,200	
1916–17	22,000	149,800
1917–18	21,100	
1918–19	21,600	150,000
1919–20	22,500	
1920–21	21,500	154,600
1921–22	16,700	
1922–23	20,300	157,000
1923–24	21,200	
1924–25	26,800	158,000
1925–26	30,200	
1926	.....	164,000

* International Cotton Bulletin.
† Jones Cotton Hand-Book.

[16] "World Developments in the Cotton Industry," page 96.

employment of existing equipment, by considering the possible consumption of existing spindleage. We can consider each spindle as consuming somewhat less than two pounds of cotton lint a week when in full-time active operation. With a spindleage of about 164,000,000 now in existence, machinery exists for the consumption of more than 30,000,000 bales of cotton annually. It will be noticed at once that the spindleage in existence during the past ten years could easily have consumed more cotton than has actually been produced. Since, too, spindles in place have been steadily increasing during the past several decades, it is fair to assume that this increase has been in response to demand for cotton manufactures. Cotton is the best fibre available for man's needs and large numbers of people are wholly dependent upon it for clothing and many other uses. As population increases, particularly with the development of Africa and South America, spindles manufacturing cotton can reasonably be expected to continue to increase to meet the increasing demand for cotton manufactures.

Large portions of the world's population, particularly in the regions where cotton makes the most desirable garment for wear, have very small incomes, and to secure large consumption, cotton must be cheap in price. It would seem, therefore, safe to say that at a given price the world can consume very large crops of cotton. Can the world produce cotton at the price which will put into active operation all the spindles in existence?

Because of the great urge among nations to acquire lands capable of producing the raw materials needed by the world, we can expect Great Britain, possessing as she does in the African colonies lands which are believed to be capable of producing large quantities of cotton, to continue the work she is doing there to supply her cotton manufacturing industry with Empire-grown cotton. Not only this urge, but the need to develop these vast regions for their own good and the help this development might give in paying the war debts and retrieving her pre-war position as the great manufacturing and exporting nation, will continue to urge her on with even greater intensity. For a number of years before the war Germany was doing some development work in this field of growing cotton in her African possessions. Today Belgium, France, and Italy are doing some development work in a small way in their African colonies. As Great Britain succeeds there, these countries can reasonably be expected to increase their efforts for very much the same reasons that urge on Great Britain. At the present time not enough is known to say that Africa will yield sufficient quantities of cotton which, with the aid of India, will supply the 100,000,000 spindles of Europe and Great Britain, but sufficient information is known to warrant the belief that the combined efforts of Great Britain and European governments, if persevered in, can furnish the 100,000,000 spindles in the course of another twenty years with 6,000,000 bales of cotton, ranging from American upland to Egyptian Sak, as against slightly more than 2,000,000 bales now.

No account is taken here of cotton growing elsewhere, as, for example, South America now producing about 1,000,000 bales and working to produce more; Russia now reported as producing nearly 1,000,000 bales, and smaller proven producing regions as Queensland in Australia, the Dutch East Indies, and some other places, all of which are reported as capable of expanding their cotton growing regions. These along with China are fruitful fields for additional growth. Our own cotton growing fields, by an expansion of 13,000,000 acres in five years, give the most impressive demonstration of cotton growing possibilities. We still have available several million acres of proven cotton growing lands. Irrigation in some of our arid western states would probably add several million more. The applica-

tion of better farming methods and greater control of insect pests and plant diseases would unquestionably add several million bales to the present production. Unfortunately we face a serious labor problem which may confine our cotton growing to 50,000,000 acres, and interfere with that intensive soil cultivation so desirable. But some improvement in cultivation, soil treatment, and control of plant diseases and insect pests, increasing the yield per acre, can ordinarily be expected to give us 20,000,000 bales annually.

Our supremacy as a cotton growing nation is not threatened. We do face, however, because of the national need of other countries to sustain themselves by drawing more on their own lands, a diminution in the call for our raw cotton from foreign lands. Instead of supplying the world with 50 to 60 per cent of their cotton needs, we shall probably furnish only 40 to 50 per cent of their needs, and we need not purposely grow small crops of cotton to drop to this percentage.

Because of competitive conditions in world markets, the price of the raw cotton is an important factor in tending to regulate the size of the crop. American cotton at twelve and one-half to fifteen cents is a great factor to the discouragement of cotton growing in certain sections of Africa. Originally Great Britain turned to the growing of cotton in Africa because of periods of scarcity of supply which quite naturally resulted in high prices. A consideration of the chart showing the results of the efforts to grow cotton in Africa reveals the fact that following the high prices of cotton during the world and post-war conditions a large advance was made. Can our cotton farmers meet the challenge of other cotton growing regions by maintaining a low price? Today cotton at twelve and one-half cents is said to be several cents a pound under the cost of production in the United States. As transportation and other conditions improve in Africa, increasing areas are

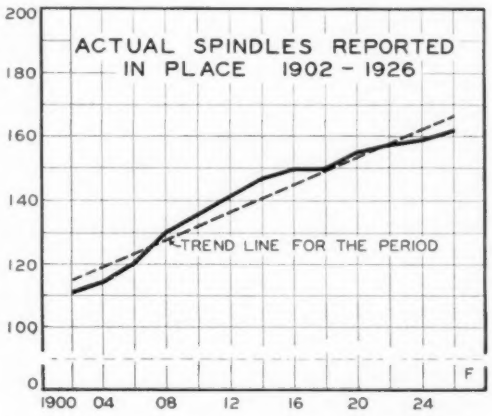

FIGURE. 18.—The chart of actual spindles reported in place for a twenty-four-year period indicates the increase in the production and utilization of cotton for almost a quarter of a century past.

growing cotton, which can be sold landed in Liverpool at fourteen cents a pound and show the grower a profit. If our farmers are to meet the challenge of Africa, South America, and Asia, which grows stronger each year, their problem is not how to prevent bumper crops, but to grow bumper crops through increased yield per acre, and under that diversification of crops which will help materially in increasing the yield, and at the same time grow food products for both man and beast which now the South largely purchases from outside her borders. Then as each crop is grown they should arrange for the orderly marketing of it with due regard to the world crop and world requirements.

Cotton after it is picked does not readily spoil nor deteriorate appreciably in quality. It is a rather simple proposition to store cotton, since when properly packed and covered, it needs only to be kept dry. Because of these characteristics, it seems almost inexcusable that an orderly system of marketing cotton has not yet been put into effect. For a long time following the Civil War it was understood that sufficient funds were not available in the South to permit of proper storing and orderly marketing by the cotton farmers. The plethora of capital so

evident in the United States today makes this reason no longer tenable. It would seem that the South needs to set up a system which will so function as to permit of orderly marketing rather than to try to effect the more difficult job of fitting supply to demand through curtailment of production. We have greater wealth only as we produce more, and when production is limited, particularly in the case of a crop like cotton, which lends itself readily to storing until needed, short crops are a calamity for all the world. This is not to be construed as meaning that the farmer should produce to sell at a loss, but rather that he should use his intelligence to so produce and market his crop that he earns a legitimate profit even in the face of a succession of large crops. To enable the farmer to do this, there is great need for fuller and more accurate world statistics of both production and consumption as well as more effective organization among the farmers, particularly in the field of marketing units.

If our cotton farmers can grow cotton to sell at twelve and one-half to fifteen cents during the next decade the world will probably be calling for 20,000,000 bales from us at the end of that period. So Great Britain can then be wisely counselled to develop cotton growing in Africa slowly, orderly, and only to meet the annual required increase in demand for the product, and to spend the major part of her time, effort, and money, now going into what may turn out to be uneconomic plans, for adding to the world's crop of cotton, in finding new uses and markets for her manufactures of cotton, as well as in the integration of her cotton industry. If we cannot bring our price down to the level necessary for greatly increased consumption of cotton, attempts to grow cotton elsewhere on a large scale will continue until the world secures, at a not very distant date, cotton at the necessary price. This may result in such a wide extension of cotton growing in Africa and South America as to affect materially the part our crop plays as a factor in world trade to the detriment of the whole United States.

COMMERCE AND TRADE ROUTES IN PREHISTORIC EUROPE

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THE merchant profession is as old as the knowledge of metals. In prehistoric times in Europe the trader was the first messenger between cultural circles and the most important disseminator of new inventions and ideas and, for many centuries, he was almost the only medium. He must have been a welcome guest whose arrival was an event of importance. When he reached a settlement, his wares were examined with care and his tales of other countries were listened to attentively. Possibly, because of this he was relatively safe from robbery when in a village, or it may be that agreements were entered into which provided for his safety, and treaties may have had their beginnings at this time. The fact that carefully prepared treaties were made long before the beginning of the Christian era indicates that such was a long established custom.*

At best, the occupation of trader was a precarious one. He had to cross swamps and primitive forests; he was in danger of getting lost, and of dying from starvation; he had to guard against river floods, avalanches, and attacks by wild beasts. In addition to the obstacles placed in his path by Nature he was in danger of being robbed on his journeys between settlements. That this last danger was a real one is seen in the many buried caches of his stock in trade which have been discovered hidden away in lonely places on moors, under rocks, and in swamps. These caches consist of broken and worn out tools taken in exchange for new tools, recently manufactured articles, moulds for casting bronze, and cakes of bronze, for the trader in the Bronze Age was also a metal worker. A gold hoard, probably that of a jeweler, recently discovered in North Germany, is interesting. The total weight of the gold is 81.75 ounces and the find consisted of paper-thin gold bowls, neck rings or torques, bracelets, and gold wire, doubtless to be made into jewelry to suit the patron's taste.

The importance of the trader in spreading ideas and cultures as he carried his wares to widely separated peoples of different cultural levels is one of the outstanding factors in the progress of civilization in prehistoric Europe. In earlier times his important wares were bronze and amber, but later he imported wine from the south, and carried on trade in salt and iron.

Development of Prehistoric Trade

The earliest human inhabitants of Europe were the hunters of the Old Stone Age, whose weapons were bone, wood, and chipped stone, and who knew nothing of agriculture, domestic animals, or pottery. They may have exchanged flint implements for shells to be used as ornaments with other families or tribes whom they chanced to meet in their wanderings, but of trade, as such, there was none. Mediterranean shells, found

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many miles from the shore, in some of their graves, can mean nothing more than this.

Later, a new people migrated to Europe bringing with them a knowledge of agriculture, domestic animals, and the technique of pottery making. These Neolithic peoples no longer wandered from place to place but had fixed places of abode with crude, but not uncomfortable, huts and villages. They were nearly, or quite, self-supporting: they made their own cloth, manufactured stone implements and pottery, raised crops, and supplied their larders with meat from their own flocks supplemented by what they could get by hunting. Under conditions such as these, there was little incentive for trade. Each village was sufficient unto itself. If a village was situated in a region deficient in flint or in rocks needed for stone hammers and axes, it might be necessary to go long distances for it, or to secure it by barter. Small quantities of amber in the Lake dwellings of Switzerland must have been secured by trade from neighboring tribes, and there is evidence that tribes in Eastern Galicia gave flint to the people of the Baltic coast for amber. Trade, such as this, was chiefly confined to the community or the cultural circle, and had little effect on the general culture of the time.

A great discovery brought the new Stone Age—the Neolithic—to a close throughout Europe, and introduced the Age of Bronze. When methods of smelting copper and tin ores were discovered and it was found that copper alloyed with tin made a metal greatly superior to copper and better than stone, the peoples and tribes everywhere desired bronze more than anything else. To the man who made his own tools and everything that contributed to his material comfort and existence, a cutting tool was of the greatest importance. For example, when Captain Cook, at the close of the 18th century, made his voyage of discovery on the Pacific, he found that the South Pacific islanders in far distant isles had heard of a new cutting material, iron, and were so desirous of it that they would give almost anything they possessed for a small piece. On one island, for example, they gave several small pigs for a sixpenny nail. The people of Europe had the same need and consequently the same desire. Moreover bronze had an additional value, as it made beautiful, useful, and durable ornaments.

Fortunately for the civilization of Europe—though a hardship at the time—workable deposits of copper ore were scarce and were limited to very small areas, and had to be transported to populous centers. Tin was even more rare. If this wonderful new metal was to be obtained, it was necessary either to go in search for copper and tin or to offer something in exchange. The peoples of the eastern Mediterranean must have sent out carefully planned expeditions, especially for the rare tin. They got copper in near-by Cyprus and elsewhere in the Near East. Spain appears to have been the principal center for tin early in the Bronze Age but later, when the great tin deposits of Cornwall, England, were discovered, tin mining in Spain became unimportant and, for perhaps more than 3,000 years thereafter, Cornwall supplied most of the tin used in Europe. Besides Spain and Cornwall, the principal sources of tin in ancient times were Persia and Czechoslovakia.

Copper and tin were obtained by barter and by forcibly compelling the natives of the metalliferous regions to mine the ores. Because of the demand for bronze tools, weapons, and ornaments, a trade sprang up which, in a relatively short time, spread over the whole of Europe. The great center of European culture was the Eastern Mediterranean. From here mariners in open boats propelled with oars and small sails went to Spain, to Great Britain, to Ireland, and to the coasts of Denmark. (The Phoenicians came much later and it was not until a thousand years had passed that they became an important seafaring nation, and

not until 700 B.C. that a Phoenician fleet circumnavigated Africa.)

In order to obtain bronze, something had to be given in exchange. Some of the commodities which were bartered were doubtless perishable, such as skins, cloth, foodstuffs, slaves, and cattle; and no record of them is preserved, but other materials were less perishable. One striking example will illustrate this point. At the beginning of the Bronze Age there were rich deposits of placer gold south of Dublin, in County Wicklow, Ireland. As soon as the gold was discovered a brisk trade with Ireland sprang up and gold was exchanged for copper and bronze. Gold ornaments of Irish manufacture found in Great Britain, France, Belgium, Denmark, and Germany attest to the extent of this trade. Note now the effect of the lack of trade. Before the close of the Bronze Age the deposits of Irish placer gold were nearly exhausted, trade waned, and civilization in Ireland stagnated for many centuries.

The rôle played by amber, "the yellow gold of the North," in the civilization of Europe is as interesting as it is unexpected. This fossil gum occurs in glacial deposits on the west coast of Jutland and in Tertiary beds on the Baltic coast of East Prussia where it is thrown up on the shores by waves during storms. Because of it Denmark became an important center for the manufacture of bronze, and for Bronze Age civilization. Amber was desired not only because of its beauty, its lightness, and the ease with which it could be cut, but also because of its supposed medicinal and magical properties. Amber from Sicily and Asia Minor had been known to, and prized by, the Egyptians, Cretans, and other Mediterranean peoples before the northern amber was known to them but it did not have the beautiful, yellow color of the fresh northern amber. It was however made into beads, and, because of its long use for ornaments, there was already a demand for it when samples of the beautiful northern amber were brought to their attention. The new amber, no doubt, immediately created a demand. Human nature being the same then as now, the demands of the ladies of the Great had to be satisfied and either expeditions were sent out or traders carried bronze to the far North to secure it. For many centuries bronze objects from the Mediterranean countries were transported along well-established trade routes to Denmark, and later to the Baltic coast, and the culture of the South was thus brought to the barbarousNorth. Not only was there trade with the South but with the East, and the West as far as Ireland.

Late in the Bronze Age and early in the Iron Age (1200–700 B.C.) an important industry in manufactured bronze sprang up in Northern Italy and the broad, fertile Po valley, where is situated the wealth and industries of the Italy of today, became a great prehistoric center for metal working. Surplus bronze vessels, ornaments, weapons, and tools were carried to the north where they were exchanged for whatever the peoples had which the bronze workers of the Po valley wanted. Of the materials imported, amber was so important that the islands near Venice were called the Electrides, "the Amber Islands." Here, in Northern Italy, the amber was worked up into beads and jewelry.

TRADE ROUTES

One can do no more than speculate as to how routes for trade were developed. The first trade was doubtless between neighboring settlements when each had something the other wanted such as flint, or pottery, or food. By such exchange between settlements, objects from a distance were slowly brought to different centers. But exchange of this kind was, for the most part, sporadic and unorganized and did not diffuse cultures rapidly or well.

After bronze came into use, such trade was quite unsatisfactory. The head of a family wanted to get implements of bronze immediately in order that he

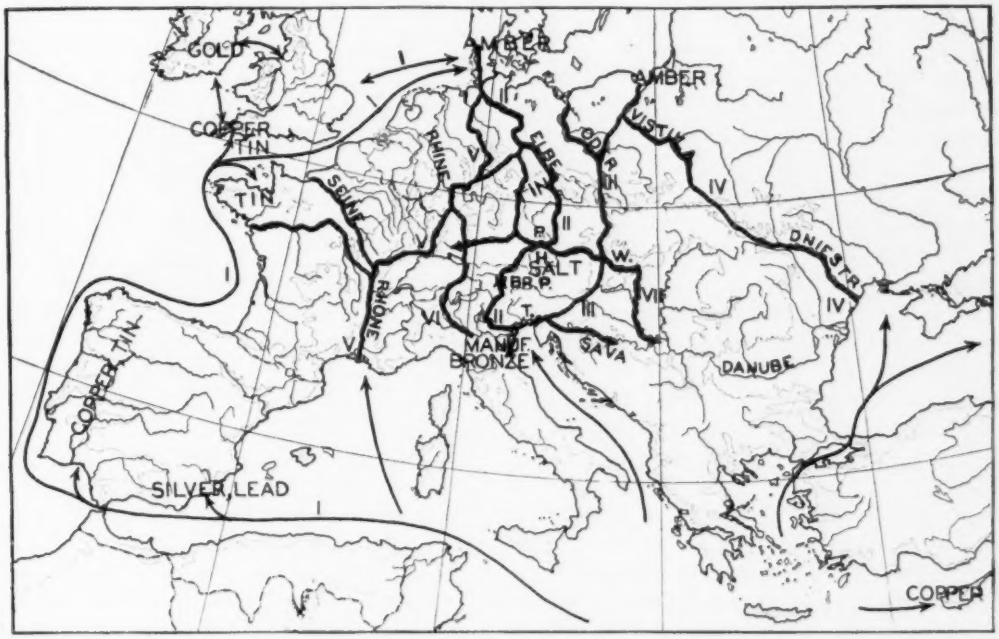

FIGURE 1.—PREHISTORIC TRADE ROUTES IN EUROPE *

ROUTE I.—The sea was used as early as the new stone age and it is probable that mariners from the Mediterranean reached Great Britain, Ireland and as far north as Denmark before metals were known, probably before 3000 B.C. In the early Bronze Age mariners were attracted to Denmark by the amber, to Ireland by the gold, to Cornwall by the rich deposits of tin and copper. When the Irish gold deposits were exhausted trade with Ireland practically ceased and civilization stagnated or decayed. Cornwall was the principal source of tin for 3,000 years and the metal was transported, largely as bronze, across the English Channel to Gaul, and thence to the Mediterranean and elsewhere. There was also a trade between Great Britain and Denmark. Marine trade with Denmark became unimportant after the opening of the land routes, especially the important Elbe route (Route II). When metallic iron came into use, land routes became less important and sea trade increased because of the widespread distribution of iron ore.

ROUTE II.—The Elbe route (the Elbe, Moldau, Inn, Adige) and Route III were the most important thoroughfares in prehistoric times. The Elbe route was first used about 1800 B.C. and continued in use until after the beginning of the Christian era. Along it amber was transported to the south and exchanged for the bronze of Bohemia and the manufactured bronze weapons and vessels of Italy. The civilization of the Bronze Age in Europe (which was far from barbarous) was largely due to the ideas and wares carried over this route by traders. When salt was mined at Hallstatt and Salzberg in the early Iron (and doubtless in the Bronze) Age, it was probably carried long distances, to Bohemia on the North, which is destitute of salt, and east and west along the great Danube route (Route VII).

ROUTE III.—The Vistula, Oder, March route became important when the amber of East Prussia was re-discovered early in the Iron Age, and along it a brisk trade was carried on, beginning about 700 B.C.

ROUTE IV.—The Vistula-Dniester route to the Black Sea was opened when Greek colonies were established on the Black Sea.

ROUTE V.—The Rhone-Rhine route became an important artery of commerce, especially after the establishment of the Greek Colony at Marseilles and along it the arts and crafts of the south were carried to the north. But it had been used for many centuries before this.

ROUTE VI.—A route of some importance which led into Italy passed along the upper Rhine, over the St. Bernard Pass and down the Ticino to the bronze workers of the Po Valley.

ROUTE VII.—The Danube valley has been populous since early Neolithic times; along it there have been repeated movements of peoples and trade routes have traversed it. The salt of Hallstatt and Salzberg and the iron workings of the early Iron Age give it a greater importance than it had previously had.

OTHER ROUTES.—The Seine, Loire, and other rivers in France, the Werra, Fulda, Saale in Germany and other stream valleys were used for local trade.

* The writer has been greatly aided in making the map on Trade Routes by Mr. de Navarro's excellent maps which show the distribution of amber finds for the Bronze and early Iron Ages of Central and Northern Europe.

might more quickly and easily add to his comfort and that of his family. He wanted bronze axes to cut down forests and thus enlarge his cultivatable land, to cut and finish wood for his house. He wanted bronze spears to aid him in hunting, and bronze fishhooks to increase his catch of fish. To man in the early Bronze Age, bronze meant not only more food but more comfort. It would have been surprising if, under such circumstances, he had not made every effort and incurred many hardships to secure, as quickly as he could, a supply of bronze instead of waiting years for it to come to him in the old way.

The first routes were doubtless on the sea, for the sea has never been a hindrance to trade, once a distant land was known to exist. The Cretans (3700–1200 B.C.) appear to have been among the first great mariners and established colonies or trading posts in Cyprus, Sicily, Sardinia, the Balearics, and on the coasts of Italy and Spain. But, for reasons that are not clear, their culture, the highest in Europe at the time, did not penetrate far inland.

It was not long after the use of bronze was known before overland routes for trade were established and commerce by sea became unimportant. The location of land routes (Fig. 1) depended upon the (1) topography, and river valleys became arteries of trade which converged at mountain passes, (2) the location of centers of population, (3) mining centers, and (4) the location of commodities that could be offered in exchange. The popular amber had much to do with the location of the land routes. Amber was an ideal product for the trader as it was light in weight, valuable, and had a ready sale. The valleys of many rivers were followed from the south to the northern coast of Europe such as the Weser, Elbe, Oder, and Vistula. Of these the most important was the Elbe. The Elbe route began on the Adriatic near Venice thence up the river Adige, over the Brenner Pass and down the Inn to the Danube at Passau according to Montelius, or where it joins the Danube at Kehlheim according to de Navarro. From here it crossed the unbroken Bohemian Forest to the Moldau and followed the Elbe to its mouth.

A second principal route began in the Gulf of Trieste and extended northeast to the Danube at Pressburg. The tributary March was then ascended and, after crossing Moravia, the route passed through Silicia and followed the Vistula to Danzig. A route for Jutland amber may have diverged from this one at Posen and followed the Oder to the coast. A third important route was by way of the Rhone and the Rhine. Besides these main "amber routes" there were paths across the Alpine passes to France and Germany; paths along the Rhone, Loire, Seine, and Rhine (Fig. 2) and connecting routes to and along the fertile Danube valley by way of the Inn, Save, and other tributaries. Another important route extended from the Black Sea up the Dniester across the divide to the Vistula and down the Vistula to the Baltic.

In the Second Age of Iron (La Tene), the Rhone carried a considerable commerce in bronze objects, wine and oil in earthenware jars (amphorae), ornaments, glass, coral, etc., and return cargoes probably, of foodstuffs, skins, and salted meats. Quantities of fragments of wine and oil amphorae in France, Switzerland, and the Rhineland show the importance of this commerce.

The effect of the introduction of iron on the trade of Europe about 1000–1200 B.C. should be noted. The new metal did not immediately supersede bronze. One can not state definitely why it did not but at least two reasons are apparent. Although bronze does not make an implement that holds an edge as well as iron, it can be sharpened easily and is much more beautiful and, moreover, had been used for more than a thousand years and was the traditional metal. Indeed, for more than a thousand years after iron had been the common material

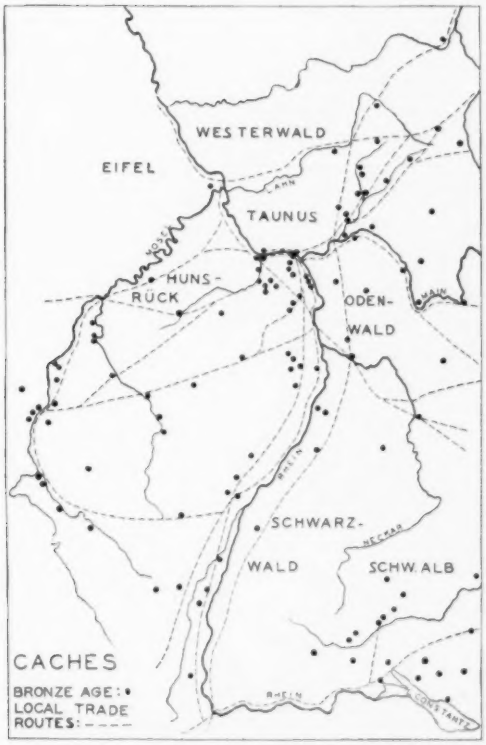

FIGURE 2.—The depots established by early traders in Western Germany, as well as the routes they followed indicate a close dependence of activity upon relief and plant cover. The routes followed stream courses or favorable terrane between bogs and forests and marshes. The depots were established where natural conditions gave the maximum safety.

for tools, bronze was the only metal used in certain religious ceremonies.

Foreign trade fell off when the use of iron became widespread. Iron deposits are much more common and more extensive than those of copper and tin, and as a result self-sufficient local centers were developed. But another factor now enters which has nothing to do with trade. Iron weapons gave a superiority to the tribes who were best equipped for warfare and conquests by force of arms caused the spread or destruction of cultures, such as the rich Mycenean civilization of Greece.

Greek colonies at Marseilles and on the Black Sea (1200–700 B.C. of late Bronze and early Iron Ages) exerted an important influence on the North. As already stated there was an important trade in wine, which was served on the tables of the rich in beautifully wrought bronze flagons (Oenochoe) of Italian manufacture. The Greek ornamentation on these flagons, and on other imported bronze objects had an important effect on the art of the Kelts which resulted in the exquisite designs of the late Iron Age (La Tene 500 B.C. to 1 A.D.).

While the trade, preceding the introduction of iron and after the land routes became known, was almost exclusively on land, traders in the Iron Age again began to make increasing use of the sea. This was due both to the fact that their boats were more seaworthy and to the falling off in the commerce of the land routes because of the numerous iron-producing communities. The land routes, however, continued to be followed and from them new ideas and new inventions were spread.

Land routes from the Mediterranean to the north coast of Europe were used at least from the middle of the third millennium before Christ. About the middle of the last millennium before Christ the amber trade of Denmark declined and trade in the Baltic amber of Prussia at the mouth of the Vistula began. As a result of this diversion of trade, the introduction of iron into Scandinavia appears to have been delayed for at least two centuries.

TRANSPORTATION

At the beginning of the Bronze Age goods were probably carried on the backs of men and down rivers in crude boats. Later, as the paths became better, the pack horse was doubtless used but, long before the close of this Age, it is probable that merchandise was transported by wagons. Discoveries in Lake Dwelling deposits of the Bronze Age in Switzerland and pictographs in Sweden prove that four-wheeled vehicles were in use. Moreover the size of some of the late Bronze Age kettles which were transported, and the trade in wine and other bulky articles in the Iron Age points the same way. Ores were carried on

pack animals as they are in Mexico today, if one may judge from the statement of Diodorus, who lived in the first century A.D., that is, at the close of prehistoric times. He says: "Traders buy tin from the natives (of England) and bring it to Gaul. Then it is carried by horses in about 30 days to the mouth of the Rhone."

After the use of iron had become universal and was more common, a considerable trade was carried on in war booty, and it has been suggested that traders (even as now) may have incited war. According to Caesar, the Servi encouraged merchants in order that they might sell the booty gained in war.

The trader endured hardships for personal gain and with no thought of the effect of his wares on the people who bought them. Nevertheless, he was instrumental in effecting a revolution both in the material, and mental life of Europe. Before the spread of metals all were relatively poor, but when ores had to be taken from the earth, when expeditions had to be sent to metalliferous regions under leaders, and when trade made men rich, a leisure class arose. No longer being obliged to spend their time in gaining a mere existence, some men were able to pick the most skilful of their followers, or to hire skilled laborers to do their bidding and invent better tools and weapons, more artistic ornaments and clothing, and, in general, to raise the level of culture. Another important result was the growth of populations, such as the first cities of Troy. Thus pride of city and national consciousness arose and a feeling of superiority of one city for another and one people for another. The possession of superior weapons encouraged leaders to make war for booty and the crowding of population led to wars for more land. With the use of metals, war, in the modern sense, began.

SUMMARY

A study of prehistoric commerce and trade routes in Europe emphasizes the fact, (1) that before the use of metals, trade can hardly be said to have existed; (2) that the widely separated and very restricted areas of copper and tin ores, which were used for making bronze, and the demand for amber gave the first great impetus to trade which resulted in the spread of civilizations; (3) that these events led to the rise of men of wealth and leisure with the result that some of the time formerly spent in wresting a mere existence from the soil, was utilized in improving the material and artistic life of the time, and (4) that because of the increase in the size of the towns and because of better weapons, war for the first time in the history of the world became a profession.

ECONOMIC SURVEY OF THE CACAO INDUSTRY OF TRINIDAD, BRITISH WEST INDIES[1]

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THE dominant feature of the world's cacao-growing industry during the present century has been the phenomenal rise in the output of the Gold Coast. In 1894, when the world's output of cacao amounted to 69,000 metric tons, the Gold Coast contributed only 9 tons, but in 1924, when the world's production had risen to 500,000 metric tons, the Gold Coast was responsible for no less than 222,279 tons, or over 44 per cent of the total. Dividing the cacao-growing countries of the world roughly into two classes, we find that those producing a superior quality cacao[2] contributed, in 1894, 71 per cent of the world's total production, while those countries producing an inferior quality[3] cacao contributed 29 per cent. By 1924 a fundamental change had occurred, and we find that the superior cacaos amounted to only 19 per cent, and the inferior to no less than 81 per cent. The Gold Coast industry is almost entirely in the hands of peasant proprietors and, for reasons which we need not examine here, they are able to produce cacao at a price with which many producers in Trinidad cannot successfully compete. Largely on account of the rapid increase in the output of cacao from the Gold Coast the prices of superior growths have been severely depressed, and the question agitating the minds of producers of such superior cacao is whether prices will continue at such an unprofitable level that eventually they will be swamped out of existence. In the following article the writer, in addition to giving a general description of the cacao industry of Trinidad, endeavours to show that estates which are located in suitable areas, and which have been efficiently managed, can still be regarded as profitable undertakings, and that the existing distress is largely the result of a maladjustment to favourable conditions, or mistaken cultural and financial policies.

The cacao tree is said to have been introduced into Trinidad by the Spaniards as early as 1525, and rapidly earned an enviable reputation for the quality of its cacao, so that by studying the history of this industry in some detail we may apprise ourselves of some of the difficulties at present facing the old established producers of good quality cacao. In order that our examination of the Trinidad industry may be made intelligible, it is desirable that we should make the acquaintance of the main commercial types of cacao, and the conditions most favourable to their profitable growth.

The tree (Figure 1) from which the cacao of commerce is obtained belongs to the family *Sterculiaceae*, genus *Theobroma* (Greek, theos, a god, and broma, food). Of the various species of *Theobroma*, *Theobroma cacao* produces more than 90 per cent of the world's cacao. The two principal varieties of *Theobroma cacao* are called Criollo and Forestero, which, in their original meanings, respectively signify "native" and "foreign,"[4] but

[1] For administrative purposes the neighbouring island of Tobago is coupled with Trinidad. Export statistics include the production of Tobago, where the general situation of the industry is much the same as in Trinidad, but a description of the location and peculiar features of the Tobago industry has been omitted since it would have involved a considerable increase in the length of this article.

[2] The more important producers of good quality cacao at the present time are Ecuador, Venezuela, and Trinidad.

[3] The more important producers of inferior quality cacao at the present time are the Gold Coast, Brazil, Nigeria, Santo Domingo, and San Thomé.

[4] Hart, in his *Cacao* (1911), retains this method of classification, and further regards Calabacillo as a distinct variety.

FIGURE 1.—A cacao tree in bearing.

since the use of the names in this sense inevitably leads to confusion, botanists have preferred to classify the trees according to the characteristics of the pods and seeds they produce. The delicate Criollo tree produces the choicest cacao and commands the highest market price but, since it is of no commercial importance in Trinidad, it need not further be considered here.[5] Forestero is the collective name for a great number of sub-varieties which form a continuous and ill-defined series, ranging from the finest Angoleta, which resembles Criollo, through Cundeamor and Amelonado, to the smoothest Calabacillo, which possesses very undesirable commercial qualities. Most Trinidad estates contain trees of each of these sub-varieties, but they have become so mixed in character that it is impossible to classify them, and so local names have been given to the most important local varieties. In parenthesis it may be noted that although the presence of many mixed varieties results in a product of lower commercial value, it nevertheless acts as an insurance against the effects of diseases to which certain varieties are particularly susceptible.

NATURAL CONDITIONS

The peculiar conditions of each individual estate, however, exercise in combination a fundamental effect—which our existing scientific knowledge does not enable us to gauge—upon not only the quantity, but also the quality of the cacao produced. Some of the more important factors may, however, be noted.

SOIL

The cacao tree will grow in a great variety of soils, but thrives best in soils which are fairly porous, rich in humus, and of good depth. The most desirable chemical constituents are an ample supply of potash, a fair supply of nitrogen, and a medium one of phosphate and lime, but the texture of the soil is equally important. Light sandy loams are preferred by many planters because they present freer drainage conditions than heavier soils, require less tillage, and respond readily to fertiliser treatment. On the other hand, they possess a smaller capacity for resisting long droughts than the heavier loams, and, if very light, are therefore unsuited to areas with a highly pronounced dry season. Good drainage, natural and artificial, is essential if high yields are to be obtained, as water-logged soils are inimical to the growth of the tree. Stiff clays, dry rocky soils, and precipitous slopes where erosion is great, are undesirable.

SITE

Soil factors must, however, be considered in relation to aspect and elevation. The cacao tree cannot withstand the desiccating effect of steady trade winds in exposed situations.[6] Since the

[5] The only Criollo trees in Trinidad known to the writer are on La Vega estate in the Ward of Montserrat. Others probably exist, but they are few in number and of no commercial significance.

[6] For this reason cacao is not grown on a commercial scale in the low lying island of Barbados which is exposed to the full sweep of the trade winds.

estate must be protected either by hill sides and mountain spurs, or artificial wind-breaks, well-sheltered valleys, which are protected by the configuration of the ground, form the most favoured sites. The tree is also susceptible to low temperatures, and since the temperature falls with rises in elevation, the height of the estate must also be taken into consideration. The mean shade temperature should be about 80° F., and should rarely rise or fall more than 15° F. above

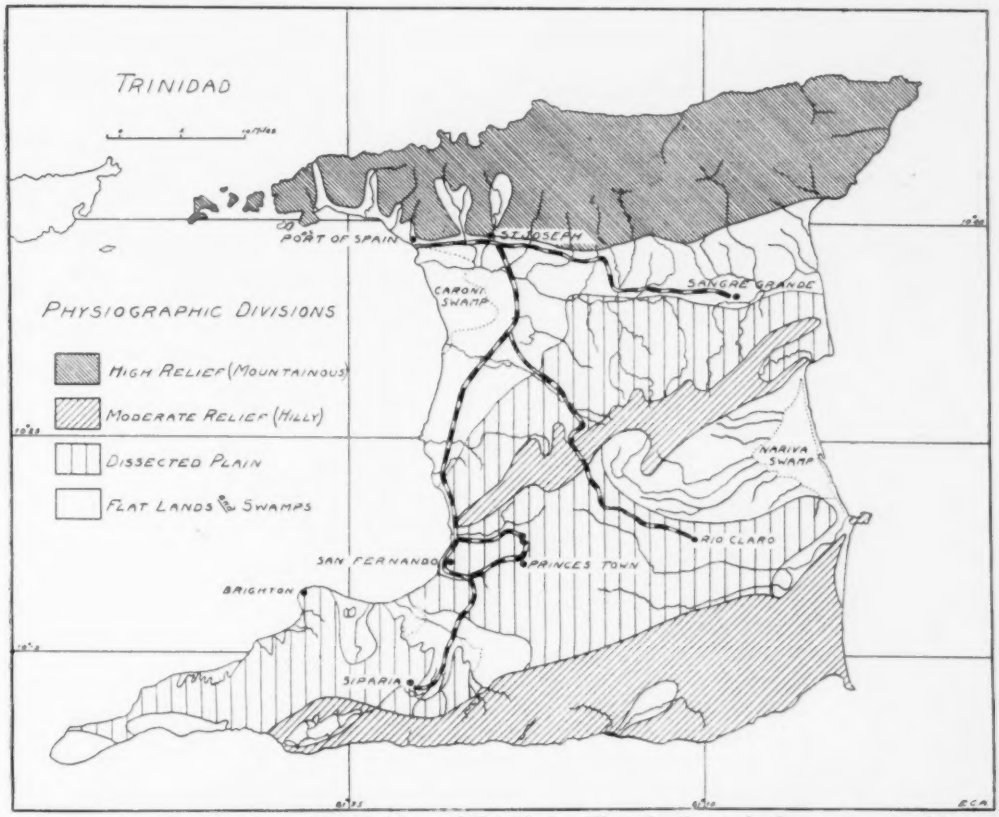

FIGURE 2.—The Physiographic Divisions of Trinidad. Though climate is the most general factor affecting life and industry, the relief and drainage help to determine the distinctive divisions of the island.

or below this point. Although cacao grows in Trinidad at a height of at least 1,875 feet,[7] it thrives much better at lower elevations (Fig. 2).

RAINFALL

The tree is capable of flourishing between a great variation of annual rainfall, H. Wright suggesting a minimum of 50 inches, and a maximum of 200 inches. Rainfall must, however, be considered in relation to the peculiar circumstances of the individual estate, such factors as soil and drainage, the distribution of rainfall throughout the year, the manner of precipitation, and the humidity of the atmosphere, being far more important considerations than mere annual precipitation.[8] In Trinidad the average annual rainfall, calculated from returns of over one hundred stations over a period of years, is 72.39 inches, but some stations on the eastern side experience falls as heavy as 124 inches, while others, on the western

[7] At La Florida estate, Caura Valley.

[8] In the Gold Coast, for example, cacao is grown successfully in some parts which experience annual rainfalls of 36 ins. to 45 ins., the favourable distribution throughout the year, and the high humidity of the atmosphere, compensating for the low annual precipitation.

side, show falls of below 50 inches[9] (Fig. 3).

SHADE

When the delicate young cacao plant is removed from the nursery to the field, it is protected by means of a temporary shade[10] of bananas, pigeon peas, tannias, cassava, or similar crops, interplanted between the cacao trees, which serve the double purpose of providing shade and yielding profitable "catch crops." The question of providing permanent shade is a controversial one upon which there exists the greatest diversity of opinion among successful planters, but is essentially a question which must be considered in relation to the other factors briefly enumerated above. In Trinidad it is the custom to provide permanent shade trees, usually of the vermillion flowered *Erythrina* (Bois Immortelle or "mother of cacao"); *Erythrina umbrosa*, or "Anauca," for the hill slopes, and *Erythrina velutina*, or "Bocaré," for the plains, the latter giving a denser covering than the former.[11] The spacing varies according to the peculiarities of the site and of the manager.

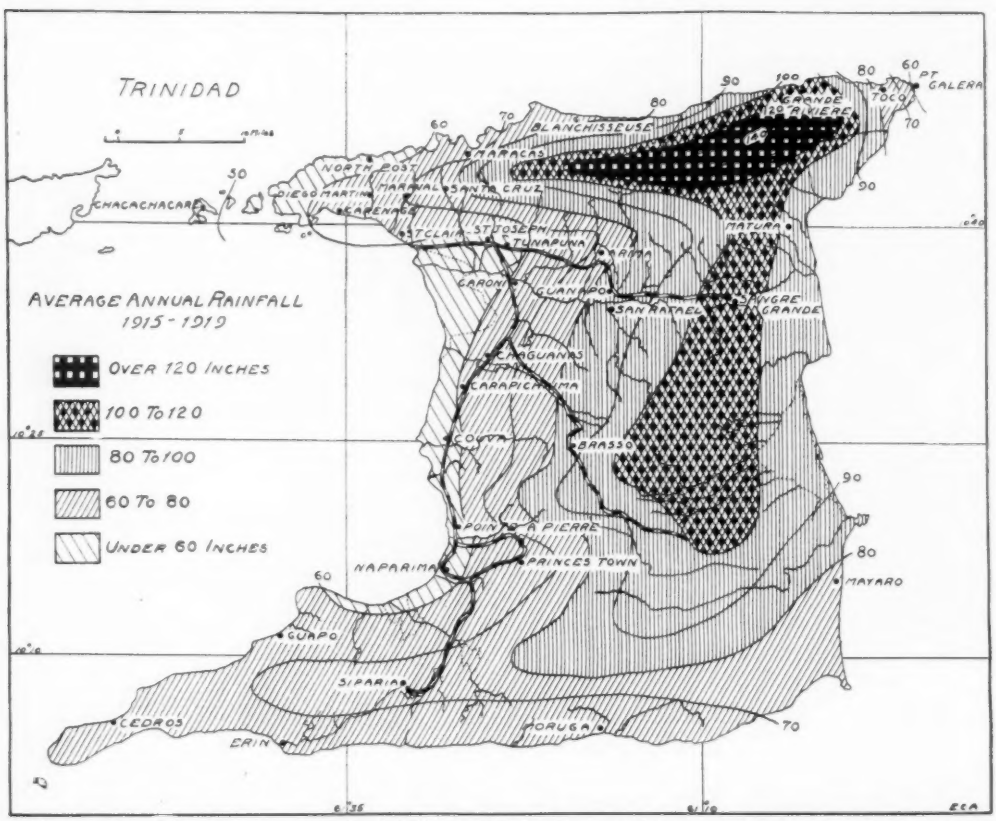

FIGURE 3.—The average annual rainfall of Trinidad from 1915 to 1919 inclusive affords a fairly reliable basis for such a map as this. The relation of location and relief to rainfall distribution is evident.

[9] Van Hall (*Cacao*, 1914, p. 329) selects two stations near the western coast of the island which have unusually low rainfalls, and draws the erroneous conclusion that, "these figures show that the rainfall in Trinidad is not very heavy for cacao cultivation and it could not be much less without being insufficient."

[10] In Brazil, and sometimes in Ecuador, the young plant is allowed to grow up without the protection of temporary shade.

[11] In the neighbouring island of Grenada cacao is grown without permanent shade, the trees being closer spaced, and a more intensive cultivation practised, while judiciously distributed windbreaks protect the trees from the prevailing winds.

OTHER FACTORS

In addition to these natural factors one must also take into consideration questions such as capital, management, communication facilities, labour, etc. These can best be dealt with in our examination of individual estates.

hardier Forastero tree and gradually the industry was re-established, albeit subjected to the fierce competition of the lucrative sugar industry. During the nineteenth century the sugar industry of the British West Indies was subjected to a succession of shattering blows the nature of which is common knowledge.

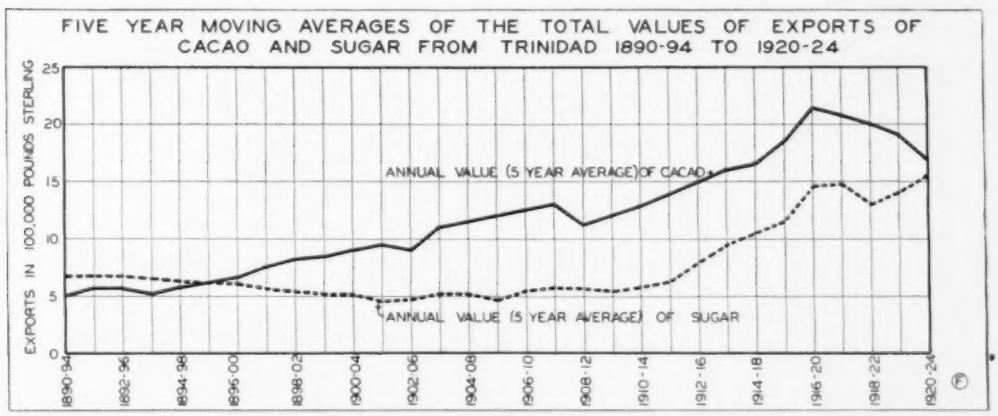

FIGURE 4.—These five-year moving averages show the trend in the relative importance of the cacao and sugar industries. The heavy fall in the price of Trinidad cacao in 1920–1921 and subsequent years is reflected in the downward trend of the curve from the five-year average, 1917–1921. There is at present very little difference in the export values of cacao and sugar.

HISTORICAL DEVELOPMENT

Having briefly reviewed these general factors, we may now proceed to review first the historical development of the industry in Trinidad, and then its geographical location. We have already noted that the cacao tree was probably introduced into Trinidad by the Spaniards in 1525, and the island appears to have exported cacao almost from its first settlement. The trees were of the Criollo variety and the cacao produced was of an exceptionally high quality, but in 1727 the plantations were destroyed by a "blast." There are no authentic records in existence to prove whether the "blast" was a hurricane,[12] a drought, or a "blight" to which the delicate Criollo proved highly susceptible.

About thirty years later some Aragonese Capuchin Fathers introduced the

This severe depression in the sugar industry tended, towards the latter part of the century, to a greater diversification of agriculture throughout the British West Indies, and was responsible, in Trinidad, for a rapid development of the cacao industry. The West India Royal Commission, quoting a return by the Superintendent of Crown Lands, gives the total area under regular cacao cultivation in 1899 as 24,158 acres.[13] Between 1897 and 1898 the acreage is reported to have increased from 98,000 acres to 103,000 acres.[14] From 1898 to 1904, 91,251 acres were alienated, practically the whole being planted in cacao,[15] and in 1904–1905 the Blue Book of the Colony gives the area under cacao as 190,000 acres. Considerable areas were subsequently planted up but, owing to the heavy fall in cacao prices since 1920–1921, some unremunerative areas

[12] Trinidad fortunately lies outside the normal hurricane zone, a fact which has been of great importance in establishing crops of the orchard type such as cacao.

[13] Report by the West India Royal Commission, 1897, C. 8655, p.102.

[14] West Indian Bulletin, Vol. V, p. 175.

[15] West Indian Bulletin, Vol. VIII, p. 141.

were later cut down. In 1924 the area was estimated at 202,106 acres [16] and, although these figures may legitimately be regarded with considerable scepticism, they will suffice to indicate the rapid growth in the importance of the industry, which now occupies a greater acreage than any other crop, and has supplanted sugar as the premier agricultural industry (Fig. 4).

FIGURE 5.—Trinidad, showing approximate area under cacao cultivation.

GEOGRAPHICAL LOCATION

The first cacao areas were established by Spanish settlers—before the island passed into English occupation—in the valleys of the Northern Range—Santa Cruz, Maracas, Caura, Lopinot, Arima, Aripo, and Oropouche valleys, named in order from west to east (Fig. 5). Some eighty years ago, after the island had been ceded to the British, and during the depression in the sugar industry, areas in the central portion of the island flanking the Central Range, were similarly opened up by Spanish pioneers. With the continued depression in the sugar industry additional capital was diverted to the cacao industry, and the Spanish settlers, who appear to have been particularly non-gregarious in their habits, sold their patches of cultivation and proceeded eastward, opening further areas of virgin forest. Cacao cultivation spread throughout Montserrat, Tamana, Chaguanas, Cunupia, Point-a-Pierre, and Savanna Grande. Numbers of East Indians, whose indentures had expired, left the sugar estates and assisted in the development of the cacao industry by occupying and planting areas in cacao.

[16] Report by His Majesty's Trade Commissioner for the British West Indies and Central America.

Some thirty to forty years ago, again during a depression in the sugar industry, portions of land in Siparia, Moruga, Erin, Cedros, and La Brea were also planted in cacao.[17] In addition various scattered areas have been established in favourable localities along the southern, eastern, and northern coasts. The main producing areas lie along the Northern and Central Ranges, the latter, although the younger, being the more important.

THE NORTHERN RANGE [18]

The northern littoral range traverses the entire length of the island and possesses an average breadth of about seven miles. A subordinate ridge rises immediately from the sea and attains an average height of 800 feet, while the main range varies in height between 1,600 feet and 2,500 feet. Several high peaks rise out of this range, the highest being Mount Tucuche (3,072 ft.) in the western section, and Mount Aripo (3,085 ft.)[18a] in the eastern section. Towards each extremity the ridges fuse together and descend towards the sea. Throughout the length of the range valleys run from north to south, making lateral communication extremely difficult. In the western part the valleys are of some breadth, the mouths usually being contracted, while the upper parts expand into basin-shaped cavities with steep slopes, but in the east the valleys are developed into deep ravines.

The Northern Range is composed of strata of micaceous quartzose schists, sandstones, limestones, and shales, and probably represents a continuation of the littoral chain of Venezuela. In the eastern extremity the schists contain intruded diorite. The disturbances to which the range has been subjected have resulted in a highly inclined, often vertical, position of the strata.

The cacao estates are established on the lower slopes and alluvial flats of the valleys. Soil erosion is heavy on the higher slopes, resulting in shallow soils, and the necessity of constructing contour drains to minimise wash, but on the flats the soil is usually of considerable depth. The trees are well protected from the easterly trades by the spurs which run at right angles to the main divide.

THE CENTRAL RANGE

The Central Range, around which the most important cacao-producing area of Trinidad is located, consists of Lower Cretaceous strata and extends from Point-a-Pierre, on the west, to Manzanilla, on the east, a distance of about thirty-five miles. The general appearance is that of a hilly country with an irregular distribution of peaks. At the western end ridges radiate from the hill of Montserrat in all directions. Portions of the Range are precipitous, but in the western part there is a considerable stretch of undulating land, admirably suited to the cultivation of cacao. The highest elevations are, proceeding from west to east, Mararaval (800 ft.); Cogollar (918 ft.); Tamana (1,009 ft.); Mount Harris (903 ft.); and Le Branche (718 ft.).

The cacao estates are situated on the vegas [19] and undulating areas, where the soil is rich and of considerable depth. The valleys are not so well defined as in the Northern Range, and communication, both internal and external, is much easier.

As already noted many other scattered areas were planted up during the continued period of higher prices, some of which will doubtless lead to further extension with more favourable prices, while others are already tending to die out.

[17] In these areas, and also in the eastern part of the island, there exist a few estates of much earlier origin which were probably planted by Venezuelans who came across from the mainland, for both the soil and type of cacao closely resemble those of Venezuela.

[18] For the geological description of the Northern and Central Ranges the writer has made free use of the *Report on the Geology of Trinidad*, by G. P. Wall and J. G. Sawkins (London, 1860), supplemented by more recent investigations and personal observations.

[18a] "Trinidad the Riviera of the Caribbean," Trinidad, 1924, p. 89.

[19] In Trinidad the word "vega" implies a narrow alluvial soil-belt bordering rivers, both in valleys and on plains.

Before considering costs of production one important difference in labour factors between the Central and Northern Ranges may be noted. The labourers on the cacao estates are of negro (usually termed West Indian), Indian (usually termed East Indian), or Spanish extraction. In the Central Range the cacao estate proprietors agitated for, and obtained, permission to secure indentured labourers from India. These labourers were legally obliged to turn out to work on five days during each week, except in cases of illness when the labourer was provided with free medical attendance and medicine.[20] The system has now been abolished by the Government of India, but while it existed it exercised a beneficial influence upon, not only the indentured labourers, but also upon the free labourers who knew that they would be replaced if they gave cause for dissatisfaction. Very few estates in the Northern Range were able to secure indentured labourers because the scattered nature of the estates, and the difficulty of communication, rendered prohibitive the cost of complying with the strict medical requirements. Numbers of free East Indians have, however, moved into these regions.

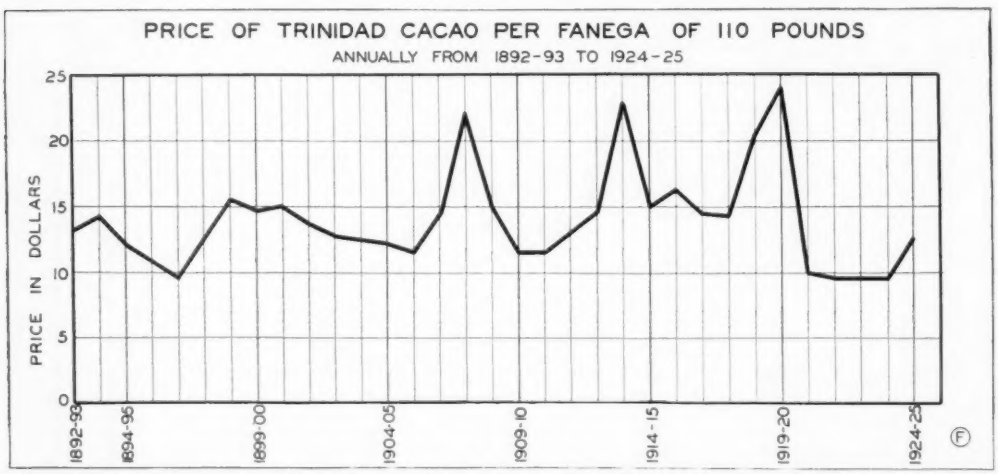

FIGURE 6.—The diagram shows the violent and demoralising fluctuations in price experienced by the industry. Particularly noteworthy is the precipitous fall in 1920–1921 and continued during the three following years, when prices were far below the normal pre-war level. (Compiled from figures kindly supplied by the Cocoa Planters' Association. These prices refer to Plantation Cacao and are therefore a little higher than the average price for all Trinidad cacao, which is composed of a considerable proportion of Ordinary or Unfermented cacao. The financial year ends on June 30 and prices are ex store, Trinidad.)

COSTS OF PRODUCTION

From the foregoing description of the Northern and Central Ranges, and bearing in mind the conditions briefly described in the earlier portion of the article, it is evident that the Central Range is better adapted for the cultivation of cacao than the Northern Range, and one would expect this to be reflected in comparative costs of production. In attempting any general statement it must clearly be borne in mind that many other factors besides geographical location exercise a fundamental effect upon costs of production. Even in the same locality subtle differences, invisible to any but the expert, result in wide divergencies in costs. As a broad generalization one can say that in the Northern Range on typical well-managed and unencumbered estates of about 400 acres, which have been kept in a good state of cultivation, and which

[20] An estate employing indentured coolies was obliged to provide for the regular attendance of a registered medical practitioner at least twice a week.

produce 7 to 9 bags [21] of cacao per 1,000 trees, or about 1.96 to 2.52 bags per acre,[22] the cost of production would vary between $10.00 and $9.00 per bag. Similar estates in the Central Range would produce cacao at between $9.00 and $8.00 per bag. These figures which are based upon an analysis of the accounts of a number of estates indicate that, even with the existing low prices (Fig. 6), cacao cultivation may still be regarded as a profitable industry.

While some estates have yields considerably in excess of those quoted above, many, unfortunately, experience much lower yields; in fact it is probable that the average production on all Trinidad cacao estates is not much in excess of 5 bags of cacao per 1,000 trees. Assuming such a yield, costs might be expected to vary between $11.00 and $13.25 per bag, according to the size and other circumstances of the estate, the former figure still affording a small margin of profit, but the latter being distinctly unprofitable. Attempting an even wider generalization, costs might be expected to vary between $13.25 per bag, for an estate producing 5 bags of cacao per 1,000 trees, and $7.25 for an estate producing 10 bags per 1,000 trees. On those estates with unprofitable costs of production one would expect other crops to enter into competition with cacao for the use of the land, and this is a problem to which increasing attention is being paid.

COMPETITION WITH OTHER CROPS FOR LAND

It may be noted at the outset that where cacao has been established under favourable conditions no other crop enters into competition with it for land. Only those marginal estates, whose existence has depended upon the maintenance of a high price level for cacao to compensate for high costs of production, have tended to substitute other crops. The choice of an alternative crop should depend upon a number of factors, prominent among which should be the probable costs of production compared with the existing and probable trends of prices of the two crops. Too often, however, the determining factor has been the attractive and existing price of the alternative crop, with the result that, for example, some heavy clay soils have been cleared of cacao and replanted in coconuts, in spite of the fact that the soil is no more suited for the production of coconuts than it was to the production of cacao. The "experience account" of such planters must be an unusually large one!

The main competing crops have been sugar, coconuts, and to a smaller extent, rubber; and of these, coconuts alone have not experienced the profound depression common to most tropical products. The recent rubber boom occurred at a date too late to have had any important effect upon the present movement. A number of estates have planted coffee as a double, or subsidiary, but not competing, crop. In the Chagunas and "Caroni"[23] districts fairly large areas of cacao have been cut down and planted in sugar cane, thus reversing the process of some fifty to sixty years ago when sugar cane gave place to cacao but, with this difference, that whereas there was a boom in cacao in those days, there is no boom in sugar at the present time. Owing to the compact nature of the soil, combined with varying degrees of cementation, in an area with a deficient and badly distributed rainfall, the yields of cacao were always low. The area generally is flat or undulating, communication easy, and central sugar factories (Woodford Lodge and Caroni) within easy reach. The change has been prompted by the necessity of making the best of unfavourable circumstances. In the neighbourhood of Carapichaima and Waterloo, where cacao had been planted in comparatively light soils with

[21] Unless otherwise stated each bag may be taken as consisting of 165 lbs. of dry cacao.

[22] Assuming an average of 280 trees per acre.

[23] The term "Caroni" is here used to denote the immediate neighbourhood of the Caroni central sugar factory.

a deficient rainfall, some areas have been replanted with coconuts. Similarly, in the southwest of the island (Erin, La Brea, and Siparia), where the annual rainfall is low, the soil very sandy, and many situations rather exposed, coconuts are similarly encroaching upon cacao areas. In Manzanilla and Toco several small cacao areas have been devoted to rubber cultivation, but this development is a comparatively small one.

Generally speaking the movement for the substitution of cacao by other crops has not progressed to any great extent, largely on account of the difficulty of finding a suitable and profitable alternative crop, and partly because the cacao estate proprietors have struggled on in the hope of a rise in the price of cacao. The possibility of developing a fruit-exporting industry, which is now under discussion, may result in a fundamental change in the situation.

COMPETITION WITH OTHER INDUSTRIES FOR LABOUR

The competition with other industries for labour has probably been a more important factor in limiting the development of the cacao industry, and has also had an important effect upon estate practice. Since the discovery of oil in the southern part of the island extensive options and leases have been granted for oil prospecting, particularly since 1912. The oil companies have employed a considerable number of labourers at rates with which the cacao industry has been unable to compete. In addition to the permanent competition of the oil and other industries the cacao industry has also had to contend with seasonal migrations. In the Central Range district particularly, labourers, especially West Indians or negros, move into the cane sugar-producing areas during the crop season (January to May).[24] Since this period largely coincides with the period of heavy pickings on the cacao estates, special inducements with regard to wages, living conditions, and task work, have to be offered to retain an adequate number of labourers. In the Northern Range and the Tamana district, where there still remain many labourers of Spanish extraction,[25] the labourers rarely migrate to the sugar estates. Another interesting migration is largely a legacy of the Great War, when adequate supplies of food-stuffs were difficult to obtain, and many of the peasantry began or extended the cultivation of provisions. On estates in the neighbourhood of Cumuto, for example, some of the labourers, usually East Indians, annually migrate to Nariva where they rent land, either from the Government or private proprietors, and plant rice. The intensity of the competition for labour varies with the situation of the estate, and is responsible for the considerable divergence in rates of pay and living amenities offered by different proprietors.

[24] Where rubber is grown this migration does not constitute any drawback, since tapping is not carried on during the dry season when sugar is being manufactured. It enables the labourers to obtain a change of occupation, which is particularly to the liking of the West Indian negro.

HARVESTING AND MANUFACTURING

The factors which we have considered in general may be better illuminated by a brief examination of two selected estates, but for this purpose it is necessary that we should have some general idea of the methods of harvesting and preparation of cacao.

PICKING

When there are sufficient ripe pods on the trees, a gang is sent out under the supervision of a driver, or foreman, to pick the cacao pods. Considerable care has to be exercised, in picking the cacao, to select only the ripe pods, and to avoid damaging the "cushions" on the trunk or branches from which the flowers and pods are produced. The cacao pickers are usually experienced men who can distinguish at a glance the subtle characteristics which denote the ripe

[25] The Spanish creoles are essentially cacao growers and rarely, if ever, engage in sugar cane cultivation.

pod. The picker is armed with a cutlass with which he severs from the tree all the ripe pods within reach, while for the higher pods a long-handled tool, known as a "picker" is used.

HEAPING AND GATHERING

The pods which have been thrown to the ground, are first collected in the field by women or children into small heaps, and then gathered by men into larger heaps, all over-ripe, under-ripe, diseased, or blackened pods, being sorted out for separate treatment (Fig. 7).

FIGURE 7.—Gathering cacao pods, a bountiful harvest.

BREAKING AND EXTRACTING

A labourer then picks the pods from the heap with his cutlass, or knife, makes a cut around the middle of the pod, and, with a sharp twist of the wrist, breaks the pod into two, throwing the separated portions to the women or children (usually two, but sometimes three, to each breaker) seated near him. The women or children then scoop out the beans, either with the hand or by means of a wooden palette, into baskets lined with banana leaves (Fig. 8).

CROOKING

The beans, which at this stage are covered with a sweet white slimy mucilage, are then headed, carried in panniers by mules ("crooking"), or conveyed in a cart—according to the relation of the field to the transport system of the estate—to the estate yard.

FERMENTATION

The beans are then usually subjected to a process known as "sweating," or fermentation, but where the necessary facilities do not exist the cacao is merely dried (Fig. 9), and marketed as ordinary or unfermented cacao, which realises a lower price than the fermented. The purpose of the treatment is to separate the pulp from the bean in order to facilitate its subsequent drying, and to improve its commercial value. In Trinidad the wet cacao is placed in one of a series of wooden boxes with perforated bottoms, covered with banana leaves, and allowed to "sweat." The beans are turned over into a fresh box, preferably every day, while the liquor, which percolates through the bottom of the box, is allowed to run away as waste. This process occupies a period of three to six days or more, the finer types occupying the shorter period, while the Calabacillo fails to give satisfactory results even if sweated for periods exceeding six days.

FIGURE 8.—Breaking the pods and extracting the marketable product.

DRYING

The beans are then removed to the drying shed, which is merely a flat floor, frequently the roof of the labourers' barracks, provided with a sliding roof which can be used to protect the cacao from the effects of rain or the fierce mid-day sun. All waste and inferior material is removed from the beans, which are spread in layers and frequently turned by wooden shovels in order to facilitate uniform drying. In wet weather, unless artificial driers are available, considerable difficulty is experienced in thoroughly drying the beans which, in consequence, have an inferior appearance, and frequently become mouldy.

CLAYING

To overcome the difficulty of obtaining well-fermented cacao during periods of inclement weather, planters adopted the practice of applying to the beans a thin coating of a very fine ferruginous clay, which, adhering to the mucilage, protected the beans from the attack of micro-organisms, and enabled the cacao better to withstand the effects of handling and transportation. The clay was dusted evenly over the small heaps of cacao while labourers "danced," or trod barefooted, upon the beans. When the drying and claying had been completed the beans possessed a high polish, resembling polished mahogany, which became the "hall-mark" of good fermented Trinidad cacao. Unscrupulous planters and merchants abused this practice by disguising inferior, and unfermented, cacao with a thick coating of clay which, in addition, added considerably to the weight of the cacao. After repeated warnings had proved ineffective, claying was prohibited in 1923, thus depriving Trinidad cacao of one of its distinctive features, and honest planters of an effective safeguard in bad weather. The beans are still "danced" (Fig. 10), but clay is no longer added. After the beans have been thoroughly dried the floors are at once scraped to remove the adhering mucilage. The beans are then packed in bags ready for transportation to the local market.

To illustrate the general condition of the industry the writer has selected two estates for examination, one in the Northern Range and the other in the Central Range. These estates should be regarded as typical, not of the localities in which they are situated, but of different types of estates distributed throughout both regions.

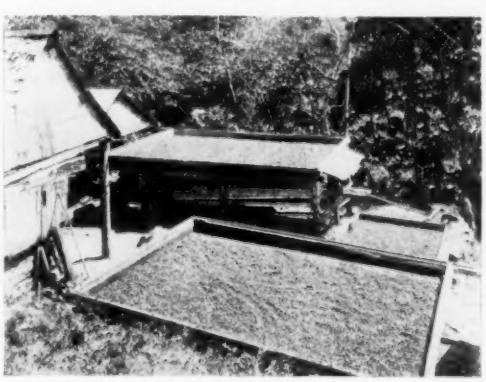

FIGURE 9.—A peasant's drying trays. Each pod produces numerous seeds. They must be dried carefully to produce the best product.

La Vega Estate

The selected estate in the Central Range is La Vega in the ward of Montserrat, about 2½ miles from the Brasso Railway Station, and 35 miles by road to Port of Spain, the capital of the Island. About seventy or eighty years ago the whole area was in the forest, but about this period peasants, of Spanish extraction, began to "squat" in this region, and gradually they cleared and planted small patches in cacao. In 1887 the present owner, the Hon. Carl de Verteuil, C.M.G., began buying these areas, the previous owners moving further afield into the forest areas of the Tamana district, where they again cleared and planted small areas (Fig. 11). With these areas as a nucleus, adjacent portions of Crown Land were purchased, cleared, and planted in cacao on the contract system. At present the total area of the estate is about 400 acres, of which about 270 acres are in bearing cacao.

The estate, which is situated at an elevation of about 400 feet above sea level, is, on the whole, flat,[26] with some undulating areas. The site is fairly well sheltered from wind by a number of well-defined ridges which run in various directions. The chief type of soil is a rich deep sandy loam, which is regarded as being among the finest cacao soils in Trinidad. The annual rainfall for the last sixteen years has averaged 84.84 inches, varying from 111.33 inches in 1921, to 67.91 inches in 1914. La Vega may be considered to be situated in very favourable natural conditions.

FIGURE 11.—Plan of La Vega showing the holdings of the former Spanish peasant proprietors. The area of each holding is given in acres, roods, and poles. All the proprietors were of Spanish extraction but some possessed names of non-Spanish origin. (The scale of existing plan is 12 Chains to the inch.)

FIGURE 10.—Drying cacao by sunlight. Constant care is necessary to develop the best grade of product.

[26] Hence the name La Vega.

The owner has followed a system of cultivation calculated to make good use of these circumstances, and one which, unlike many others, has not been radically altered to suit price fluctuations. Particular attention has been paid to drainage, the whole estate containing no less than 103 miles of drains. Each year moss, epiphytes, and dry branches are removed from the trees, which are also given a moderate pruning, based upon a definite policy, and not, as on some estates, subjected to a sporadic and vigorous pruning once in several years. The fields are cutlassed and kept free from weeds, and some part of the estate is forked and manured every year.

The system of cultivation is fairly intensive and this, combined with favourable natural conditions, is reflected in exceptionally high yields. The average yield per acre over the whole estate has

varied between 2.9 and 5 bags of cacao per acre, or about 11.6 to 20 bags per 1,000 trees.[27] On one field, 5½ acres in extent, which incidentally is the oldest field on the estate, and had not until this year been manured, the average yield for the past fifteen years has been 4.9 bags per acre, or 18 bags per 1,000 trees.[28] These figures should be compared with the average yield for Trinidad, which the writer estimates at a little more than 5 bags per 1,000 trees.

La Vega is surrounded by other fairly large estates so that there is considerable competition for labourers, and special inducements have to be offered to retain an adequate force. The wages of the ordinary day labourer are 45 cents per day for men, and 30 cents for women. All the labourers are housed in the estate barracks or dwellings, and they may, if they desire, have a parcel of land for cultivating provisions, though few, strangely, avail themselves of this privilege. Fruit grown on the estate can be had gratis, on request, and when ill, the labourers are supplied with free medicines.

The labour force is composed of West Indian negroes and East Indians, the former being in the majority. While the indenture system was in force, the estate maintained thirty to forty indentured East Indians (coolies), who were paid 25 cents per working day. Although real wages were roughly equivalent to the present-day rates, the estate was in a much better position because it could always rely upon securing an adequate number of labourers. Now that the suspicion of compulsion has been removed the labourers show a tendency to absent themselves from work when the state of their finances does not render exertion imperative.

Since the abolition of any and all forms of compulsion, and on account of the labourers' "negatory predisposition" to work—a feature by no means peculiar to Trinidad or even to the coloured races—planters have introduced the system of "task work" by which the labourer is paid according to the "task," or agreed amount of work, and not by time. The labourers prefer task work because they can, if they wish, hasten with their work and finish earlier than the day labourers, the supervision is less exacting, and they work when and as they please. To the estate the system has the advantage of reducing costs of supervision, and rendering it easier to obtain and retain labourers.

At La Vega time and task work are about equally divided, the principle being briefly this: if the work can be easily and accurately measured, and the haste or carelessness of the labourers is not likely to damage the cultivation, the work is done by the task; if the contrary is the case, the work is done by day labourers. On some estates, either owing to the difficulty of obtaining sufficient labourers, or to the short-sighted policy of the manager, or owner, in enhancing the present profits at the expense of the future, work is performed by the task which would be more economically performed by day labourers.

Trinidad cacao estates are, on the whole, remarkably free from serious pests and diseases, and, largely owing to the good state of cultivation in which La Vega is kept, such pests and diseases as do exist give no cause for anxiety and are effectively dealt with in the ordinary estate routine.

The main criterion of the factors described is to be found in the costs of production. In 1924, a year of poor crops, when 824 bags were marketed, the average cost of production amounted to $8.22 per bag, or $5.48 per fanega.[29] In 1925, although the total expenditure had risen from $6,777.46 to $7,446.24, the increased crop [30] of 921 bags resulted in

[27] The average number of trees per acre on this estate is about 250.

[28] The average number of trees per acre on this field is about 270.

[29] A fanega is an old Spanish measure equivalent to 110 lbs. A bag of 165 lbs. is, therefore, equivalent to 1½ fanegas. One fanega = 50 kilos; 20 fanegas = 1 metric ton.

[30] Both crops were below the average.

the lower cost of production of $8.08 per bag, or $5.39 per fanega. The total receipts during 1924 and 1925 were $11,802.00 and $16,690.42, respectively, the profits representing an average return of 7 per cent per annum on the capital invested. The total cost of transporting the cacao from the estate to the store of the Cocoa Planters' Association, through which the cacao is marketed, amounts to about 36 cents per bag of 165 pounds, or 24 cents per fanega.[31] These figures demonstrate that, in spite of the low prices prevailing during the past few years, a cacao estate which is located under favourable natural conditions, efficiently managed, and adequately capitalised, can be run at a profit and yield a moderate return upon the invested capital. We have already indicated that many estates have been unable to clear expenses during the past few years, and it is desirable that we should examine the estates of the Windward Islands Estates Company in order to ascertain why this should be the case.

The Windward Islands Estates Company's Estates

The principal estates of this company are situated in the Caura valley, and consist of La Concordia, La Florida, and El Manacal, which, for the sake of brevity, will be referred to collectively as the Caura estates. La Concordia and La Florida are contiguous, the former occupying the alluvial flats and the lower slopes, while the latter joins it at about the 700-foot contour, and rises to cross the divide and descend some little way down the slopes of the next valley, the highest point under cacao cultivation being 1875 feet above sea level. The annual rainfall for La Concordia is 60–70 inches, and that for La Florida 65–75 inches. The total acreage under cultivation on the two estates amounts to 410 acres, while an additional 150–200 acres is occupied in buildings, pasture, high wood, and land too precipitous for cultivation. El Manacal is situated at the very head of the valley in a deep, damp basin, rising, with very steep slopes, to the summit of the main divide of the Northern Range. The annual rainfall lies between 90 and 105 inches, the dry season being less marked than on either of the other estates.

The estates are well protected from the prevailing winds by the main spurs which run at right angles, and the secondary spurs which run parallel to the main range. The slopes are steep and in some cases precipitous, the range in height being from 250 feet at the main depot, to 2,000 feet at the crest of La Florida. The soil on the slopes is mainly a disintegrated shale, the strata of which have been subject to much contortion, and in general are inclined at a high angle of elevation. Outcrops of limestone occur at various heights. Owing to the great erosion which has taken place, the soils are very shallow and an elaborate contour drainage system has been rendered necessary to prevent further denudation. On the flats the soil is a rich alluvium of considerable depth.

Natural conditions are less favourable than at La Vega, but other factors have to be taken into consideration to account for the recent experience of these estates. As with La Vega the area was originally opened up by Spanish peasants, some of whose titles extend back to the period before British occupation, and a few bearing trees exceeding 100 years in age are still to be found on the present estate. By the foreclosure of mortgages, and the buying out of unencumbered estates, these small areas were aggregated into larger units, and by 1902 the area had been consolidated into the existing estates, at which period the owner was bought out by the Windward Islands Estates Company. The executive offices of the Company are in New York and, prior to 1918, there was no active control

[31] Cartage from estate to nearest railway station (Brasso), 18c per bag of 220 lbs. Railage from Brasso to Port of Spain, 11c per 100 lbs. Cartage from the Port of Spain railway station to the Cocoa Planters' Association's store, 3c per bag of 220 lbs.

over the management by executive officers, with the result that an investigation in that year found the estates in a practically derelict condition.

These facts are reflected in low yields which, during the past ten years, have averaged only 1.5 bags per acre, or 5 bags per 1,000 trees, the highest average being 1.75 bags per acre, or 5.83 bags per 1,000 trees, on La Concordia, where natural conditions are most favourable, and the lowest average 1.13 bags per acre, or 3.77 bags per 1,000 trees, on El Manacal, where natural conditions are least favourable.

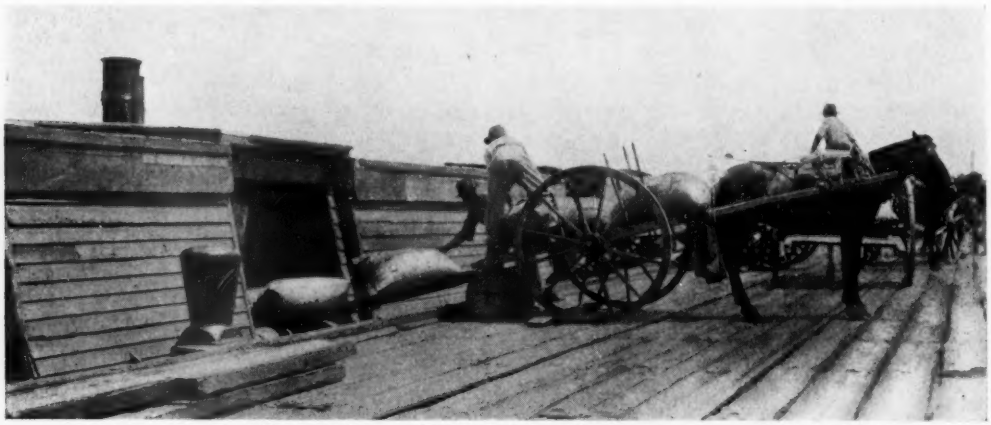

FIGURE 12.—Loading a lighter. Most of the product is exported to Great Britain.

Labour conditions, however, are very favourable at La Concordia and La Florida which are situated in an area where there exist a number of small peasant proprietors, mainly of Spanish extraction, each of whom owns a house and cultivates provisions such as tannias, cassava, and corn, and, occasionally, small patches of cacao or coffee. When required these peasants work as labourers on the estate, but at other times they cultivate their own land, so that there is not the necessity, as at La Vega, for finding constant employment. Both La Concordia and La Florida maintain, in addition, about twenty-five estate labourers who live in barracks. This gives considerable flexibility in the labour supply and on La Concordia it has been found possible to vary the number of labourers from 25 to 70 within four days. These small holders do not migrate to the sugar plantations during the crop season so that an ample supply of labour is always assured.

The labour situation is very different at El Manacal, although this estate is only four miles from La Concordia, because it is surrounded by large estates which enter into competition with it for labour. Consequently all the labourers, numbering about thirty adults, live on the estate in barracks, and in order to retain them it is necessary to find work for them at all periods, no matter whether such work is, or is not, essential.

No indentured coolies were maintained on these estates owing to the difficulty of complying with the medical requirements, but a few East Indians have since moved into this neighbourhood and acquired small holdings. The rates of pay for male day labourers vary between 40 cents and 45 cents per day, while the rate for women is 25 cents per day. The Caura estates have, therefore, some advantage over La Vega with respect to labour.

In 1918 the administration of the estates was vested in resident officers of the Company, and a policy of rapid rejuvenation formulated. This restoration was carried out in a piecemeal manner and involved very heavy expenditure, some conception of which may be

gained from the fact that on La Concordia, while the average price per bag during the period 1918–1925 was $20.51, the average cost of production during the same period amounted to no less than $25.33. The total excess of expenditure over revenue on the three estates during the past five years was $28,604.37, but of this a considerable proportion should be regarded as capital expenditure, since the estates have been brought from a state of abandonment to a profit making basis.

At the commencement of this transformation an interesting experiment in double cropping was inaugurated, coffee (*C. arabica*) being interplanted throughout the cacao fields. It was realised by the authorities that intensive cultivation must be a concomitant of double cropping, and so, forking, mulching, and the application of artificial manures, have become a part of the routine work of the estates. So far the experiment has amply justified itself, and coffee is providing an increasingly important part of the revenue while, at the same time, increasing yields of cacao have resulted in spite of generally unfavourable seasons.[32] From the current year the cost of production is estimated not to exceed $10.50 per bag of cacao, a figure which, although in excess of La Vega, will nevertheless afford, at existing price levels, a moderate percentage return on the capital investment.

The Caura estates furnish an excellent example of the ease and rapidity with which profitable and well-established estates can be allowed to relapse into a derelict condition, and the heavy expenditure necessary in order that they may again become profit-making concerns. These estates have, however, had the backing of a powerful financial organisation, an advantage denied to other estates whose condition we may now describe.

Most of the estates in Trinidad have been established under the contract system[33] whereby the contractor, usually of the peasant class, engages to clear and plant the land in cacao and bring the trees into bearing, being rewarded by the free use of the land for the purpose of growing provisions, and the payment of a fixed price per tree, varying between 15 cents and 25 cents per full bearing tree, on the termination of the contract. This system has developed on account of the shortage of labour, and is certainly the least costly and easiest method of establishing a cacao estate, and is satisfactory when the contractor is honest and industrious. The disadvantage lies in the fact that if the contractor is dishonest it is impossible to secure any redress, owing to the poverty of the average contractor.

The cost of establishing a large estate frequently ran into several thousands of pounds, and many planters borrowed money, at rates of interest varying between 6 per cent and 12 per cent per annum, on mortgage for this purpose. The cacao industry is characterised by a high capital investment in comparison with the annual turnover, so that the cost of production must permit of a high margin of profit if an adequate return upon the invested capital is to be secured.[34] The high productivity of the virgin soil, and the high value of cacao, enabled this interest to be paid without difficulty, and mortgages on cacao estates were regarded as a "gilt-edged investment." Proprietors who were accustomed to live up to the full limit of their incomes during prosperous years found themselves obliged to increase their indebtedness in bad years. Those who borrowed heavily upon the highly inflated valuations of the boom immediately prior to 1921, found themselves unable to meet the annual interest charges during the slump which followed. Many planters have endeavoured to reduce their so-called costs of production by

[32] The yield of cacao on all flats has averaged 18 bags of cacao per 1,000 trees per annum during the past two years.

[33] These contracts are now regulated by the Agricultural Contract Ordinance of 1889.

[34] For a detailed example see page 21.

neglecting cultivation, which inevitably results in reduced yields and involved financial condition.

To alleviate what was regarded as a temporary difficulty the Government introduced the Mortgages Extension Ordinance (No. 65 of 1921) with the object of preventing mortgagees from realising their mortgages before June 30, 1923, provided the interest on the mortgage was not more than six months in arrears. At the same time an Agricultural Relief Ordinance (No. 66 of 1921) was enacted, authorising the Government to make advances to cacao estate proprietors for the purpose of meeting interest and cultivation charges.

Owing to the unexpected continuation of short crops and low prices, the Mortgages Extension Ordinance was extended (by Ordinance No. 17 of 1923 and No. 14 of 1924) to March 31, 1925, when it was allowed to lapse, while the Agricultural Relief Ordinance was continued in an amended form. By Ordinance No. 12 of 1924 an Agricultural Bank was established, with a capital of $1,200,000, for the permanent benefit of agriculture in general, and cacao in particular, by the granting of mortgages not exceeding $10,000 (subsequently increased to $15,000), at 7 per cent interest per annum, both principal and interest being repayable by half-yearly instalments over a maximum period of thirty and a half years. The loan must not exceed 50 per cent of the valuation of the estate and must, in the first place, be applied to liquidating any existing mortgages.

Of the 350 applications made to the end of May, 1926, no less than 195 were refused. Loans amounting to $524,550 were approved for the remaining 175 applicants, and it is expected that many of these will eventually regain financial stability. Twenty-one temporary advances, involving loans amounting to $14,800.90, were also granted. The operations of the Bank reveal the fact that, through unfavourable conditions, or bad management, or lack of capital, many estates have become involved in difficulties from which they can only be extricated by a rapid rise in prices. It is probable that many of these estates will eventually be abandoned, replanted in other crops, or sold to those who may eventually place the estates on a paying basis after the elimination of the heavy burden of interest charges.

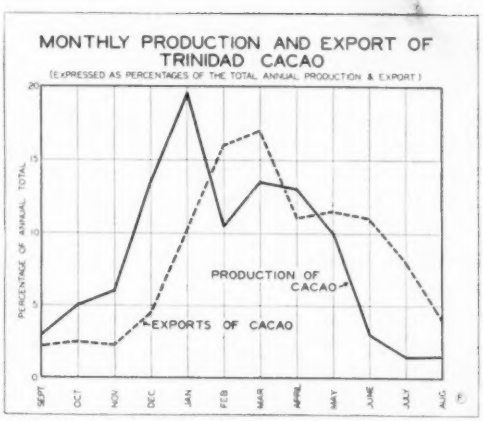

FIGURE 13.—The curves indicate the seasonal nature of both production and export and show that the service of storing is performed outside the country of production. The lag between picking and export normally varies between six and eight weeks. (The production curve is compiled from monthly returns of pickings from a number of representative estates in Trinidad and Tobago during the period, 1911–1912 to 1924–1925. The export curve is complied from shipping returns kindly prepared by the Secretary of the Chamber of Commerce, Trinidad.)

A brief description of marketing will complete our survey of the industry. Peasant proprietors and other small producers usually dispose of their cacao through the local provision shops to which they are frequently indebted. The larger estates sell their cacao to one of the merchant houses in Port of Spain, Sangre Grande, or San Fernando, while a few ship direct. There is no local exchange and samples are hawked from store to store until the most satisfactory price is offered. The Cocoa Planters' Association,[35] which is organised upon a co-operative basis, markets the cacao of 200 estates and now exports approximately 20 per cent of the total crop of the

[35] See, The Cocoa Planters' Association, *Tropical Agriculture*. Vol. II, No. 12. pp. 289–291. Trinidad, 1925, price 6d.

colony. Quite 60 per cent of the total output is dealt with by the four largest exporters, while the twelve largest merchants handle more than 90 per cent of the cacao exports. In addition there are many smaller merchants, most with a sound commercial reputation.

At the store the cacao beans are emptied, sorted, and thoroughly mixed, in order to secure uniformity of quality, by the absence of deep water facilities at the quay.[37] Sales are usually made direct on a c.i.f. basis, only a small quantity being marketed by consignment. The geographical position of Trinidad renders it a very favourable market for holding in anticipation of prices changes in London or New York, but the climatic conditions are unsuitable and the beans tend rapidly

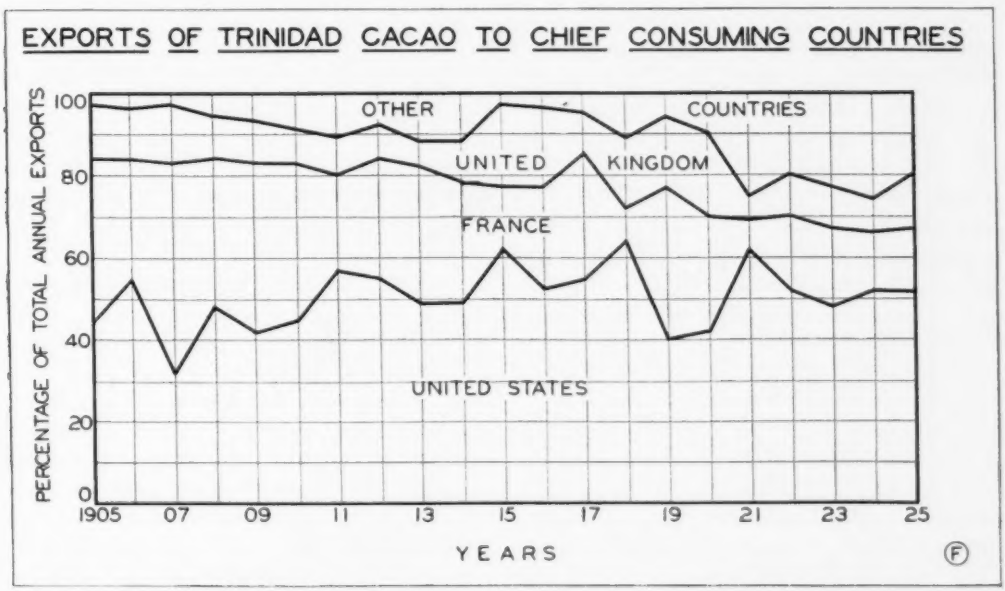

FIGURE 14.—This diagram shows the great importance of the United States of America and France, particularly during the earlier period, as importers of Trinidad cacao. The United States of America still imports about 50 % of the total production. Although France has declined in relative importance she still remains the second largest importer. During the period under review other countries (the more important of which are Germany, Holland, Australia, and Canada) have increased their percentage of exports purchased from about 3% to about 20%.

It should be noted that the exports refer only to the immediate, and not necessarily to the ultimate, destination. It is curious, for example, to note that 61% of the total Canadian imports of cacao are received indirectly via England (36%), the United States of America (24%), and other countries (1%). It is unknown how much Trinidad cacao is ultimately imported into Canada, but the recent Canada-West Indies Treaty will probably result in all such imports of Trinidad cacao being marketed direct. (Compiled from shipping returns kindly extracted by the Secretary of the Chamber of Commerce, Trinidad.)

and then repacked in bags[36] marked with the name and brand of the exporter. When ready for shipment the bags are trucked out, loaded on small two-wheeled carts, and deposited into lighters (Fig. 12) which are rendered necessary to become mouldy if stored. The markets in fact seldom get "out of line," and the stores are not equipped for holding more than the peak supplies, so that any interruptions due to lack of shipping

[36] The shipping bag contains 200 lbs. of cacao. The term "bag" used as a measure of weight is misleading since the weights contained vary, not only in different countries, but also within the same country.

[37] The cost of marketing by the store amounts to about $1.03 per bag of 200 lbs., the amount being composed of: bag 65¢; labour 12¢; export tax 2¢; cartage to quay 2¼¢ (18¢ per load of 8 bags); staff, office expenses and rent, about 22¢. (Figures supplied by the Cocoa Planters' Association.)

facilities, unfavourable markets, etc., rapidly cause congestion (Fig. 13).

The most noticeable feature of the exports for the period 1905–1925 is the large proportion taken, particularly during the earlier years, by the United States of America and France. The United States of America still remains by far the most important market and takes, on an average, 50 per cent of the total production. Although the relative importance of France has declined she remains the second largest importer of Trinidad cacao. The proportion going to other markets has increased from 19 per cent in 1913, to 33 per cent in 1925 (Fig. 14). The United Kingdom is characterised by the limited demand for the finer qualities of fermented, or plantation, cacao, whereas France usually purchases unfermented, or ordinary, cacao. The United States of America exhibits no well defined peculiarities.

SUMMARY

The industry is now in the midst of a crisis. Although always important, the cacao industry received its great impetus from the depression of the sugar industry, and the contemporary high value of cacao. Under this stimulus estates spread into areas where their existence depended upon the maintenance of this high level of prices, and heavy indebtedness was incurred in the firm belief that such would prove the case. Prices slumped unexpectedly in 1920–1921 short crops have been experienced during each of the following years, and the amazing development of the Gold Coast, flooding the world's impoverished markets with cheap cacao, seemed likely to swamp out of existence the producers of superior types of cacao. In Trinidad the industry is painfully adapting itself to the limitations of existing economic conditions. The marginal estates are slowly succumbing and, with the continuance of existing circumstances, the industry will contract until it occupies only those areas possessing the most favourable natural conditions. The writer has endeavoured to show that, even under existing circumstances, Trinidad cacao estates which are located under favourable natural conditions, unencumbered, and efficiently managed, have little to fear from the competition of the Gold Coast, and the industry may rest easily.

COLOMBIA'S INTERNAL DEVELOPMENT

G. T. Renner, Jr.
Economic Geographer, Columbia University

AN Associated Press dispatch from Bogota, Colombia, dated August 31, stated briefly: "Colombia proposes to float an international loan of $100,000,000 in 1927 to build railroads and highways." [1]

The Commercial and Financial Chronicle, quoting the *New York Times*, states that "half a dozen large Wall street banking houses have been competing for a Colombian loan, amount to be about $40,000,000. It was understood that a former Colombian Administration had completed arrangements for a large loan from the United States. The administration went out of office and resumption has been delayed by this political change."

The recent resumption of the plan to float this loan in the United States has provoked a good deal of interest in Wall Street, but the facts that lie behind the loan are but little understood by the average business man, and by the general reader, perhaps, not at all. Indeed, the latter is apt to dismiss the matter with a shrug or to wonder vaguely what is the reason for this sudden interest in what he most likely terms "one of those little Latin American Countries."

COLOMBIA—A LARGE AND VARIED COUNTRY

The present interest in Colombia is not, however, one of sudden development, for the pending loan of $40,000,000 is but one of the steps in the long line of advancing interest which Americans have been building up in that country as part of the participation in the general development of the Caribbean region by the United States. Neither is Colombia a small country as is commonly supposed. In fact, that republic is one of the large countries of the world for it has an area estimated at 441,000 square miles, nearly ten times as large as New York state, and approximately one-seventh the size of the United States.

Colombia is a land of varied physical conditions. Extensive plains border the oceans to the north and west, rising through a zone of hill country to a great plateau which stands more than a mile above sea level. This great plateau is deeply cut by the several northward flowing rivers—the Atrato, Sinu, Cauca, and Magdalena. To the east and south, the plateau descends abruptly to the great lowland of the Amazon and Orinoco.

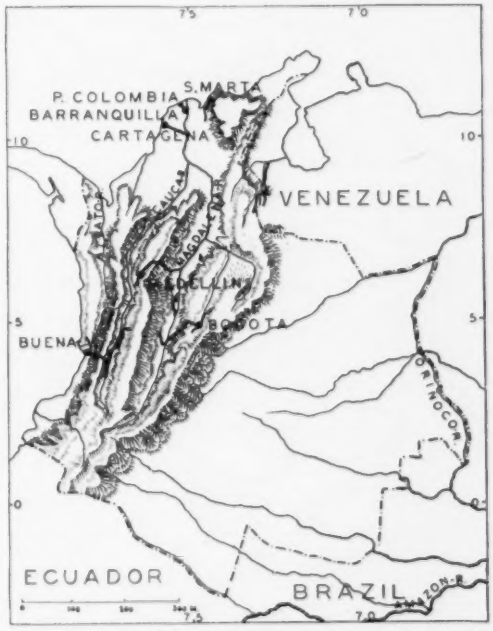

FIGURE 1.—That transportation facilities in Colombia are inadequate for the proper development of the resources is clearly evident in this map. The relation of the few railway lines to the mountain ranges is likewise quite apparent.

The climate is as varied as the topog-

[1] *New York Times*, Sept. 1, 1926, page 31.

raphy, for the hot and humid equatorial climate of the coastal plain, the forest-choked valleys, and the Amazonian selvas contrasts strikingly with the temperate, vernal climate of the plateau, or the almost semi-arid character of the vast grasslands of the Orinoco plain.

CHARACTER OF THE POPULATION

The Spanish began the settlement of Colombia a few years after Columbus discovered America, but here, as elsewhere in the American tropics, the white man has survived only upon the plateau in the interior of the country where the elevation gives a climate somewhat like that of the temperate zone.[2] Today the population is estimated to be about five million, of which 15 per cent are Indian, 45 per cent Mestizo, 30 per cent Mulatto, and not more than 10 per cent pure Spanish.

The average population density is about 10 per square mile, a figure which eloquently tells the tale of Colombia's lack of internal development.

materials for making iron and steel, and yet there is only one small smelter in the entire country.[3] The capacity of this smelter is 30 tons per day and it is operated but very intermittently. (The average output per smelter in the United States is 600–700 tons per day.) Petroleum is known to exist in large amounts, yet it is at present practically untouched. Forest resources of timber, nuts, tannin, rubber, chicle, and balata are exploited but feebly. The llanos of the Orinoco constitute one of the really great potential cattle pastures of the world, but they lie unused and inaccessible. The agricultural lands of the plateau produce temperate zone cereals and meat for only small local population while the tropical lowlands with all their possibilities of cacao, sugar, rubber, cotton, fruit, vegetable oils, and other tropical products which the industrial temperate zone is demanding in ever-increasing quantities are, with the exception of the small Santa Marta area, practically untouched.

Colombia is truly a land of natural

FIGURE 2.—A Magdalena River steamboat taking on its cargo of coffee, one of the products of the country that might be greatly increased if transportation were improved. (Courtesy of Ewing Galloway, New York.)

UNTOUCHED RESOURCES

Colombia possesses coal, iron ore, manganese, and limestone—all the raw riches. Why then have its resources been so little developed? The answer lies not in the character of the people, the climate, the political situation, nor any one of a dozen factors which have

[2] J. R. Smith, "Economic Importance of Plateaus in Tropic America," Bull. of Amer. Geog. Soc., Vol. 43, pages 36-45.

[3] Statesman's Yearbook, 1926.

FIGURE 3.—Puerto Cabello, the seaport for Barranquilla. (Courtesy of Keystone View Co., New York.)

been advanced as explanations of Colombia's lack of development. The answer lies in the physical nature of the country, for Colombia is divided into three very dissimilar natural regions—the coastal plain, the great mountainous interior, and the low-lying plains of the southeast. These regions are practically inaccessible to one another, and only the coast region possesses easy access to the outside world.

The highland interior contains most of the people of Colombia and yet so broken is it into mountains, plateaus, and river valleys that the local population groups are much isolated from one another. Bogota, the capital of the country, is located on the largest of the inland plateaus and is the center of the largest group of white population. Indeed, Bogota is the social, political, and economic heart of the country. But so isolated is this region from the sea that although the Plateau of Bogota is the center of wheat production and might easily supply the entire country with wheat, flour for the coastal cities is imported from the United States.

FIGURE 4.—An important street in Barranquilla, the chief commercial outlet for the whole Magdalena River district. (Courtesy of Keystone View Co., New York.)

THE NEED FOR ROADS AND RAILWAYS

Colombia is, practically speaking, a country without roads. The location of the population centers on interior highlands has here complicated the usual difficulties of tropical development. The mountainous character of the country has rendered costly and difficult the construction of both trunk roads and railways. And yet both are necessary for any measure of development which may take place in the country. The roads are usually mere mule trails, although perhaps a thousand miles of main roads fit for motor traffic have been completed by the Government. In addition there is a little less than a thousand miles of meter and narrow gauge railway in operation. These railways are operated by fifteen different companies, which shows that instead of being a trunk line they are really nothing but a number of small local lines, inadequate to meet the transportation needs of the country or to contribute to its general development. Most of the inland transportation is by river and this of course is north-south, for the parallel mountain ranges preclude east-west traffic. The Magdalena, one of the great rivers of the world, is the

main highway of the country, being navigable for some 900 miles, while the other rivers provide lesser commercial arteries. But the seasonal nature of the rainfall causes the rivers to be unnavigable much of the year, the lack of heavy forests on the highlands causes their channels to be filled with sand bars, and the tideless character of the Caribbean allows their mouths to become choked with sand. In short, the Magdalena is an exceedingly poor highway to serve any country as a national trunk line. The railways are merely tributaries or feeders for the Magdalena or else serve to portage goods around rapids and other obstructions in the river.

FIGURE 5.—Loading coffee onto primitive dugouts at Girardot, Colombia, to be floated down the small tributary stream to the Magdalena, where steamers will pick it up. (Courtesy of Ewing Galloway, New York.)

A JOURNEY TO BOGOTA

From New York one may reach Puerto, Colombia, by steamer in five or six days. From Puerto, Colombia, the route is over seventeen miles of meter gauge railway to Barranquilla, a quaint old town of white-walled Spanish architecture—one of the oldest cities of America. The railway from Puerto, Colombia, to Barranquilla serves to carry freight and passengers around the sand-choked delta of the Magdalena. At Barranquilla a change is made from railway to a stern-wheel steamboat of the Mississippi River type. For the first 60 miles the channel is deep and wide, but the following 500 miles is through a bewildering sequence of sand bars, braided channels, sunken tree trunks, and swamps. Day after day the little boat, carefully screened from the mosquitoes, plows its way through unending jungle, oppressive heat and humidity, stopping at intervals to take on wood for fuel. At Dorada, freight and passengers are transferred to a narrow gauge railway and carried 70 miles around an impassable rapid, thence onto another smaller steamboat and 50 miles upstream to Girardot, the head of navigation for ordinary boats. The river at Girardot is 600 feet above the sea and it has taken nine or ten days to make the ascent. Eight thousand feet above on the plateau is Bogota, reached by means of a tortuous railway some 80 miles long.

After all of this difficulty in reaching the center of the country, the traveler is prepared for the worst; but to his surprise, Bogota is a city of 170,000 where one may see the latest Parisian styles and witness all of the grandeur of Spanish society. For in addition to being the center of gravity of Colombia, Bogota lays claim to being the intellectual and cultural center of South America.

But the grandeur of Bogota is not supported by the export of cereals, meat, coal, or other staples. Coal at fifteen dollars a ton or wheat at seven cents a pound could obviously stand no such transportation as is afforded by the Magdalena system.

GREAT RESOURCES BUT SMALL TRADE

The only sort of goods which can stand such costly and slow transportation are commodities of small bulk and great value which are relatively imperishable. The chief articles exported are coffee, gold and platinum, emeralds, tobacco, hides, and Panama hats, all of which fill the above requirements. It is apparent from this list of exports that the ostentation of Bogota is based not on the sound economic development of the country as a whole, but upon the exporting of

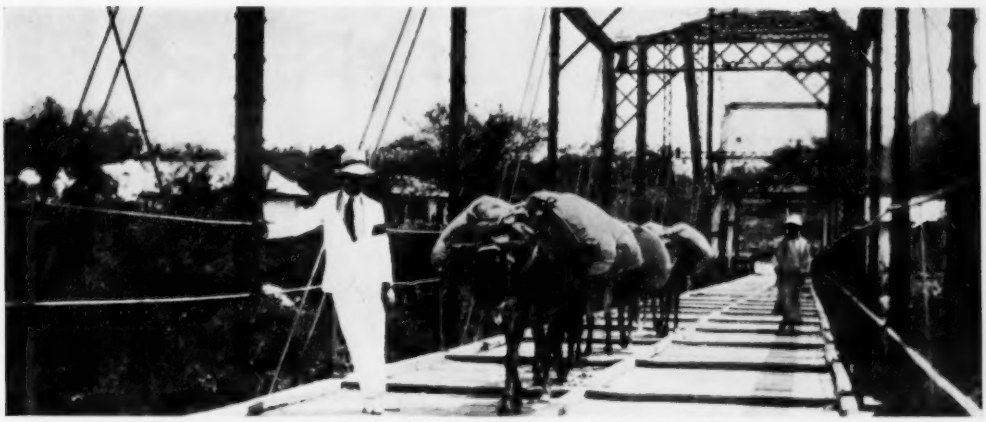

FIGURE 6.—Bringing coffee on the backs of mules from the interior hill country of Colombia near Honda, to be shipped down the Magdalena River by steamer. (Courtesy of Ewing Galloway, New York.)

a few articles by a small class of the population. The only exception to this is the export of bananas by American interests from the coastal section of Colombia.

The imports tell the same story: cotton goods, cutlery, foods, drugs, men's and women's furnishings—all in small amounts. Every machine, boat, printing press, or automobile must be carried into the country in pieces, either by boat or on the backs of mules—and at an enormous cost.

development can take place till some more satisfactory system of transportation is put into operation.

AMERICAN OPPORTUNITY

It is with this in mind that the Colombian Government is earnestly attempting to borrow $100,000,000 for the purpose of building roads and railways, $40,000,000 of which will doubtless soon be raised by Wall Street.

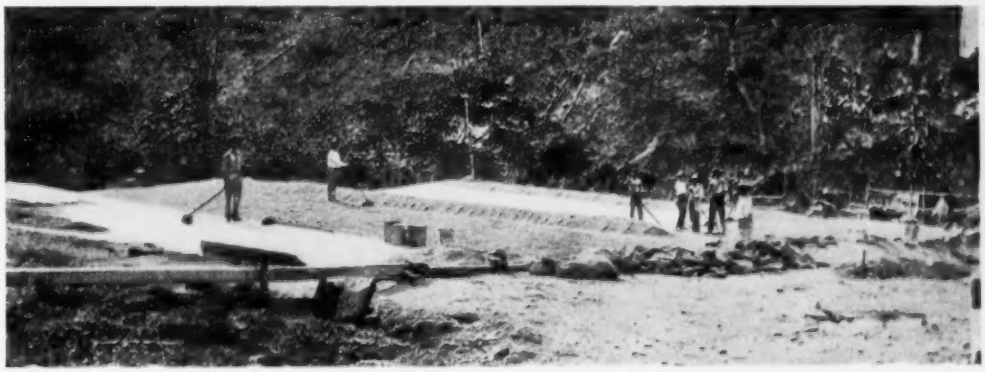

FIGURE 7.—Drying coffee in highland Colombia. Colombia produces a fragrant, mild coffee which is becoming one of the leading exports of the land. Improved transportation will make Colombia a successful competitor of the great coffee-growing regions. (Courtesy of Ewing Galloway, New York.)

It is no wonder then that Colombia is, in general, extremely undeveloped, or that the bulk of the population is poor and uneducated, and that their buying power is almost nil. No matter how rich are Colombia's resources no general

At present, nearly five-sixths of Colombia's exports go to the United States. In other words, Colombia with all its possibilities of tropical production is open unqualifiedly to the demands of American industry—a demand which is as yet

merely in its infancy. American industry will more and more draw its raw materials from the Caribbean region and any financial assistance extended to Colombia by American bankers will mean more and cheaper raw materials for manufacturing in this country.

Not more than half of the imports into Colombia come from the United States, England being a close competitor in the selling market while Germany is a fair third. Already British capital controls five of the fifteen railways in Colombia and British capital has aided in the building of some of the national railways. The $40,000,000 which is forthcoming from Wall Street will be sufficient to complete only the railway from Bogota to Beneventura on the Pacific, but there still remains to be constructed the far more important rail route from Bogota and Medellin directly to the Caribbean. If American money finances the whole transportation scheme in Colombia, markets for American goods would rapidly open up instead of passing into British and German hands. In addition, the source of future raw materials for American industry in Colombia would be safeguarded and assured.

BOOK REVIEWS

DEPARTMENT OF COMMERCE

Bureau of Foreign and Domestic Commerce

Foreign Commerce and Navigation of the United States, Calendar Year 1925, Vols. 1 and 2.

This statistical presentation of the foreign commerce of the United States is issued in two volumes for the first time. The price of Volume 1 is $1.50 and of Volume 2, $1.25. These books contain a number of new tables regarding our foreign trade. The summary tables are extremely valuable in that they go back in some cases for 15 or 20 years, thus providing a basis of comparison not hitherto available in one volume of our foreign trade statistics. The detailed material for 1925 covers exports and imports of gold and silver, and of merchandise by commodities and customs districts. The last table in Volume 2 presents a basis for worthwhile geographic analysis. In it, statistics are grouped by continents and countries, in each continent the most important commodities in the export and import trade of that country with the United States being shown both for 1924 and 1925 in quantity and value.

Colombian Public Finance. By Charles A. McQueen.

Trade Promotion Series No. 43. Price, 20 cents. Interwoven with this discussion of financial conditions in Colombia is a large amount of material which bears directly and indirectly upon geographic problems. The first part of the bulletin is an historical survey covering the development of activities in Columbia from the early Spanish times down to the present. There is a certain amount of background material in the portion of the bulletin devoted to the departmental finances, while that relating to railroads indicates areas of present and proposed development.

British Wages. By Charles E. Lyon, American Trade Commissioner, London.

Trade Promotion Series No. 42. Price, 15 cents. While this subject is not directly geographic, nevertheless many of the conditions discussed are the outgrowth of basic physical conditions, and it provides a valuable study to parallel any survey of Britain.

International Trade in Coffee. By M. L. Bynum.

Trade Promotion Series No. 37. Price, 20 cents. The text and extensive trade statistics for coffee make this a bulletin of unusual value. The situation in coffee-producing regions throughout the world is described with considerable detail and the international movement of coffee analyzed.

Great Lakes-to-Ocean Waterways. By E. S. Gregg and A. Lane Cricher.

Domestic Commerce Series No. 4. Price, 25 cents. This bulletin is a careful and intensive study of the various possibilities of linking the Great Lakes to the ocean with waterways deep enough for ocean-going craft. The possible traffic along any of the proposed routes is summarized statistically by commodities and tonnage. Maps present the different routes available and commodity maps indicate the exports of wheat and other products from the interior to the seaports. Detailed statistical tables assembled in an appendix present this movement statistically. The traffic along the Great Lakes is given by commodities for lake ports and ocean ports from which the goods are exported. For the St. Lawrence canals the traffic is shown by commodities.

Florida Transportation Field Survey. By A. Lane Cricher and Edwin Bates.

Domestic Commerce Series No. 17. Price, 20 cents. This was a survey made by the Department of Commerce at the request of the American Railway Association because of the transportation difficulties which developed during the boom period of 1925. The movement of commodities was studied individually and related to various terminal districts. The results of these studies appear in text, statistical tables and graphs, while a county map outlines the territory tributary to each terminal district. Such a study contains valuable suggestions for the geographer.

Market Research Agencies.

Domestic Commerce Series No. 6. Price, 15 cents. This is a valuable bibliography both arranged topically covering commodities and various other subjects relating to market.

Markets for Canned Foods in the Western Hemisphere. By B. R. Hart.

Miscellaneous Series No. 128. Price, 25 cents. American canned foods are shipped to many countries, and a variety of conditions influence their distribution. This study covers the distribution and potential markets in the western hemisphere.

Trade Information Bulletins. Price, 10 cents each.

454 *Naval Stores.* George H. Priest.

440 *Markets of Central Chile.* Rollo S. Smith

441 *Central Light and Power Plants in Australia and New Zealand.* Howard E. Way.

442 *Asbestos, Sources and Trade.* Mineral Section, Bureau of Foreign and Domestic Commerce.

445 *International Trade in Toys.* J. M. Calvin.

450 *Leather Industry and Trade of Sweden.* Emil Kekich and J. Schnitzer.

449 *Potash in Poland.* Ronald H. Allen.

447 *Paper and Paper Products in India and Ceylon.* J. W. Vander Laan.

443 *New Zealand, Its Resources and Foreign Trade.* Emmett A. Chapman.

444 *Trading under the Laws of Czechoslovakia.* Dr. Gustav Svamberg.

451 *German Chemical Developments in 1926.* William T. Daugherty.

452 *Sumatra, Economic and Commercial Survey.* Based on reports from Sydney B. Redecker.

448 *Liner Predominance in Transoceanic Shipping.* E. T. Chamberlain.

BUREAU OF STANDARDS

Standard Time Throughout the World.

Price, 5 cents. Here is given the history of the beginning of the use of standard time, its legal establishment and use in various countries and parts of countries throughout the world, as well as the United States. One table shows the time in the large cities of the United States when it is 12 noon eastern standard time. Another lists the stations transmitting time signals giving their call letters, wave lengths, and the hour when the time is broadcasted. A third table of considerable length indicates the time in foreign countries and many foreign cities when it is noon at Washington, together with the kind of time used in these places, their standard meridian, and the difference between their time and Greenwich time.

BUREAU OF THE CENSUS

Farm Population of the United States, Analysis of 1920 Farm Population Figures, Especially in Comparison with Urban Data, together with Study of Main Economic Factors Affecting Farm Population. By E. Truesdell.

Census Monographs VI. Price, $1.75. In this volume are discussed the changes in ratio between rural and urban population and the reasons for such changes. The larger part of the publication consists of statistical tables.

United States Census of Agriculture, 1925.

New York	Indiana
Ohio	Michigan
Colorado	Montana
Illinois	Utah

Price, 10 cents each. These reports give statistics for different states as to farms, farm property, crops, livestock products, farm values, mortgage debt, acreage, and farm population.

UNITED STATES COAST AND GEODETIC SURVEY

Isostatic Condition of the United States as Indicated by Groups of Gravity Stations. By William Bowie. Serial No. 366. Price, 5 cents.

United States Coast Pilot, Alaska; Part II, Yakutat Bay to Arctic Ocean. 2d edition. Serial No. 357. Price, 75 cents.

Map of Hawaii.

Size 33 x 35 inches, Revised, 1925. Price, 75 cents. In addition to the above, large general map of the Islands are detailed maps of each island in the Hawaian group ranging from 25 to 75 cents each. All of this material may be obtained from the United States Coast and Geodetic Survey, Washington, D. C.

BUREAU OF FISHERIES

Alaska Fishery and Fur-Seal Industries in 1925. By Ward T. Bower.

Document No. 1008. Price, 20 cents. This publication deals with the fishing and fish canning industry of Alaska and the fur seal operations on the Pribilof Islands.

Fishery Industries of the United States, 1925. By Oscar E. Sette.

Document No. 1010. Price, 20 cents. This is a report on the fishery and fish canning industry operations during 1925.

BUREAU OF MINES

Mineral Resources of the United States, 1925.

These separate pamphlets are 5 cents each, and reports on the following minerals are available:

Abrasive Materials in 1925.
Barite and Barium Products in 1925.
Chromite in 1925.
Gold, Silver, and Copper in South Dakota and Wyoming in 1925.
Gypsum in 1925.
Iron Ore, Pig Iron, and Steel in 1925.
Lead in 1925.
Lead and Zinc Pigments and Salts in 1925.
Lime in 1925.
Manganese and Manganiferous Ores in 1925.
Mica in 1925.
Natural-Gas Gasoline in 1925.
Phosphate Rock in 1925.
Salt, Bromine, and Calcium Chloride in 1925.
Secondary Metals in 1925.
Talc and Soapstone in 1925.

UNITED STATES NAVY

Hydrographic Office

Table of Distances Between Ports via the Shortes. Navigable Routes.

H. O. No. 117. Price, 45 cents. This bulletin of nearly 300 pages lists ports large and small all over the world. For each port it gives the distance in nautical and statute miles to certain other ports via a given route which is the shortest. These bulletins are on sale at the United States Hydrographic Office, Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE *The Hevea Rubber Tree in the Amazon Valley.* By Carl D. la Rue.

Department Bulletin No. 1422. This bulletin, by a specialist in the rubber investigations, is based upon careful field work in the Amazon Valley and is illustrated with a number of well-chosen pictures. The status of the rubber industry in the Amazon Valley is outlined carefully, and the plantation possibilities there evaluated. A helpful bulletin for a geographer.

HELEN M. STRONG.

GOODE, J. PAUL, and BAKER, O. E. *Wheat; Production and Trade,* (1) *United States-Canada,* (2) *The World.* The first in the Goode-Baker Series of Economic Wall Maps. 5 feet 4 inches high; 3 feet 10 inches wide. Rand McNally & Company, Chicago.

These exceptionally fine maps present graphically as much geographic material as could be included within the covers of a large volume. The statistical data represented would in themselves occupy many pages; while the areal extent and distribution of wheat production over the whole world and by regions which are so vividly portrayed would require many more pages for exposition; and an account of the direction and volume of commerce which these maps indicate would necessitate a goodly book for this one purpose alone.

It has often been stated, and with truth, that the best map is but a generalization. But the gulf between the accuracy and authenticity of the best maps, of which this wheat map is an excellent example, and the inaccuracy and error of poor maps, which are all too common, is like the gulf between midwinter midnight and midsummer midday. It is perhaps no exaggeration to state that no American maps have heretofore come off the press, which have involved such painstaking care and caution to achieve the highest degree of accuracy and trustworthy representation as these, and which so truthfully and legibly present the salient facts, as well as the manifold details of the production, consumption, and exchange relationships of one of the world's most important commodities.

Doctor Baker, who is economic analyst in the U. S. Department of Agriculture, has devoted many years of careful and thoughtful study to the statistics upon which these maps are based, and to the best method for their presentation. He has patiently assembled the latest data from every available source, most official; while Doctor Goode, who is professor of geography in the University of Chicago, with his long experience in map design and map making, has done his part well in providing the homelographic base in cooperating with Doctor Baker in devising the graphic methods of presentation and in supervising the publication of the maps. It is highly commendable that they have given due credit to Miss Sophie A. Saucerman and Miss Margaret A. Hitch, their research assistants, to whom they entrusted the laborious collection and reduction of data, and to Mr. R. G. Hainsworth, their chief draughtsman, to whom the credit is due for the excellent craftsmanship that the map exhibits.

The upper map represents the wheat production of the United States and Canada, and the movement of the crop to the centers of consumption and export. The production of winter wheat is distinguished from that of spring wheat by using black dots for the latter, red dots for the former, each dot representing an average annual production of 200,000 bushels during the period 1919–1924 for the United States and 1920–1924 for Canada. The northern limit of production is marked by a black border, the southern by red. Receipts are shown at each major market by circles and shipments by similar circles segmented to show destination. Flour is shown separately from wheat by means of shading.

The internal movement and exports of Canadian wheat and flour are represented by red lines, those of the United States by black lines; flour exports are indicated by hollow bars, wheat by solid bars. The actual figures of receipt, shipments and movement are to the nearest million also provided near each graph. An inset map shows the acreage, yield per acre, and production of every state in the Union and of every province in Canada. An inset table supplies the statistical basis for this inset map. Another inset map shows the wheat surplus or deficit for each state and province.

To state that this map of United States and Canadian wheat production and trade is the best that has ever been made, would fail utterly to convey a correct impression of its excellence. No other such map has even approached it in trustworthiness of basic data and graphic detail, and maintained such distinct and lucid legibility. It is by far the best dot map presented to the American public.

The lower map is of world production and seaborne trade. Like the upper map it is a dot and line map of exceeding accuracy, both as regards quantity and distribution but not so superlatively accurate, because the statistical data are not for such small units and cannot be so definitely placed. Like the upper map, it is almost a compendium of visualized statistics on wheat—for the world rather instead of for North America. Inset maps of the wheat-growing regions of South America, India, China, and Australia supply details that the larger maps cannot. An inset chart of world production, consumption, and trade supplements the map.

The authors deserve the gratitude of all students of geography, economics, agriculture, and commerce, to whom these two maps will be a boon. They are to be congratulated upon this first great instalment—so well done—of their ambitious project. If the rest of the maps (and

many are projected) are as valuable and comprehensive as this, the series will constitute one of the finest atlases ever produced.

The publishers deserve great credit, too. A map-publishing house that assumes the responsibility for such an elaborate undertaking as this series promises to be, should certainly receive the patronage of the discriminating public as well as the professions concerned. A poor map is an abomination; a good one, a convenience; an excellent one, a benefaction.

And this is an excellent map!

W. ELMER EKBLAW.

PEATTIE, RODERICK. *College Geography*. 495 pages, including bibliography and index. Maps, illustrations and diagrams. Ginn and Company, Boston, 1926. $3.00.

The increasingly important place held by geography in universities and colleges has created a demand for texts in which the fundamental principles and relationships of the science are presented from a mature point of view. This need has been met during the past decade by a number of books, the majority of which have emphasized the economic aspects of the subject; in fact, almost without exception, college geography texts have been industrial and commercial. The ever-growing appreciation of the value of geography in its interpretation of history, political science, anthropology and sociology, as well as of economics, has called for a college text which will serve a wider scope of interests. Economic geographies, physiographies and various glorified syllabi have satisfied the general need inadequately. Therefore, Dr. Peattie's *College Geography* makes a timely appearance, for while the point of view is anthropogeographic, the essential groundwork of principles for subsequent economic courses is well laid. As an introduction to geography, the text includes (1) an analysis of environment and (2) the application of these principles to life relationships. The plan of the book is logical and direct; the method of treatment consistently unified.

Chapter I properly presents the field and function of geography and emphasizes its limitations. Chapter II, *Our Climatic Environment*, analyzes the elements of climate, temperature, winds, humidity, and precipitation. Although written in simple language, nevertheless the discussion introduces the vocabulary essential to the understanding of this division of geographical literature. The treatment of Ferrel's law of deflection which most authors disregard will be welcomed by inquisitive students. World climatic types are reduced to a minimum (1) Middle, (2) Intermediate, and (3) Extreme, a reduction which the organization of the text and subsequent treatment of details justify. Chapter III, *The Importance of Variability*, presents a discussion of weather forecasts, weather and progress and climatic fluctuations. Chapter IV, *Jungle, Savanna and Desert*, and Chapter V, *Nomadism of Desert, Steppe and Tundra*, focus attention on the adjustments of primitive peoples to geographic environment in specific regions and on the geographic causes and historical results of nomadism. Chapter VI, *Forests and Mediterranean Tree Crops*, closes the discussion of the major type regions. The author here considers the effect of natural vegetation on man's occupations and development.

The sea, its margins and islands are analyzed in a most interesting trilogy of Chapters (VII, VIII, and IX). This series illustrates the well-balanced treatment characteristic of the entire book from the point of view of content and organization. *River Arteries, Plains and their Soils, Mountains and Mountaineers* and *Natural Resources* (Chapters X, XI, XII, XIII) complete the analysis of environmental elements, the application of them to economic life and their rôle in history. The concluding chapter, *The Unreliable Earth* (XIV), focuses on catastrophic occurrences in environments,—earthquakes, volcanoes, and avalanches. It is unfortunate that the study culminates in a consideration of the unusual in the geographic environment. An expansion of the author's excellent but brief conclusion into a chapter to illustrate the "composite picture" of environmental reactions would have sustained the unity of thought to a satisfying conclusion.

"Suggestions for Study" follow each chapter. Inasmuch as the book is planned for the beginner in geography these suggestions will provide a valuable supplement to the text. Although a few non-geographic and some too obvious questions have crept in, on the whole they are thought provoking.

Especially to be commended is the well-organized and balanced bibliography, inclusive of interesting, varied and accessible references, which will appeal to the diverse interests represented in a college geography course.

The author's choice of diagrams bespeaks familiarity with student needs and point of view. Figure 129 (the foehn wind) and Figure 138 (inversion of temperature) embody simple concrete illustrations of important climatic principles. Although the pictures are as well chosen, the maps and diagrams on the whole are clearer and in most cases are more effective. Credit should accompany certain statements and diagrams which have previously appeared (*i.e.*, Figure 127 and lines 18–19, page 322).

Considering the scope of the text, errors are few. The terminology used in the classification of climatic types may lead to confusion—*middle* and *intermediate* connote a similar relationship. The importance and wide application of the principle of the monsoon, as well as its human significance, would seem to warrant a somewhat more detailed treatment than the author accords it.

The suggestions regarding map study (page 49)

are on the whole admirable, but we question the desirability of assigning a list of place names to be memorized prior to their study as they occur in the text. The reviewer believes that the concept of location may be better acquired through association—by the use of atlas and text coincidently.

Dr. Peattie's text is commendable because of its wide adaptability with respect to needs and background of college students. It should develop an attitude of open-mindedness, and it is quite sure to stimulate an active interest in the subject. The author has forwarded the cause of geography in the preparation of this excellent text.

RUTH E. BAUGH.

JONASSON, OLOF. *Näringskarta över Jorden.* A world map on a scale of 1: 20,000,000 of agricultural regions based entirely and solely upon products of forest, field, pasture, and plantation with four inset maps on a scale of 1: 80,000,000 to present relief, temperature and rainfall, natural vegetation, and Sweden's foreign trade. 4 feet high, 6 feet wide. Generalstabens Litografiska Anstalt, Stockholm, Sweden, 1926.

Dr. Olof Jonasson, now assistant professor in the College of Commerce, University of Stockholm, Sweden, has made an exceedingly valuable and noteworthy contribution in this map to the cartographic knowledge of the world, particularly in the field of Economic and Commercial Geography. It represents the sum total of a vast amount of the latest and most authentic information available, and very strikingly presents some excellent broad generalizations as well as significant detail.

In a most convincing way, Doctor Jonasson has divided the surface of the earth into five major provinces: I. Field and animal husbandry, or Temperate, province; II. Subtropical fruits, or Mediterranean, province; III. Plantation, or Tropical, province; IV. Rice, or Monsoon, province; and V. Unproductive Province (Deserts, Tundra, etc.), and has distinguished these provinces by tints and shades of different colors. These provinces stand out on the map, distinct and sharp even at a long distance, and graphically emphasize the area and location of the several major types of agriculture, wherever they be. If he had done nothing more than delimit so definitely and accurately these major regions the author would have justified the publication of the map.

But these major provinces are subdivided into regions characterized by some definite product or group of products upon which a specialized type of agriculture or industry is based; these regions give the clue to the character of human activity and occupancy as well as to the social organization. Doctor Jonasson has delimited these regions upon the basis of statistical information from the most authentic sources, and has discriminated most carefully in the selection of the data. Like the major provinces, these regions are made to stand out vividly from one another by judicious contrasts of tints and shades of the province color, and by conventionalized symbols that are in some cases almost descriptive in themselves.

In addition to these regional data, Doctor Jonasson has indicated on the large map the limits of production of the four principal cereals, the limits of tree-growth, the limits of palm-tree growth, the isotherms of 10° C. during the growing season and of 20° C. mean annual temperature, the relative net tonnage of the trade in the principal ports of the world, and the principal railways and steamship and sailing routes of the world.

The inset maps of temperature and precipitation, natural vegetation, and Sweden's commerce are all excellently done; but the map of relief is not so creditable as the others, in that it does not so clearly distinguish the several altitudes; but all the inset maps enhance the value of the main map.

Besides these maps, a chart of the continental distribution of water-power, both developed and potential, and a table of comparative production of the principal commodities in the trade of the world, fill in spaces about the main map that would otherwise be blank. The legends for all the maps are clear, adequate, and appropriate.

Doctor Jonasson is to be congratulated upon the successful culmination of this project, which represents many years research and study, not only in Sweden but in America and other foreign lands as well. His contribution takes rank as one of the most valuable among recent works of this kind, and places him in the first rank of workers in this broad field. He merits the gratitude of students and scholars the world over, as his map commands their interest and approval. If this map were in English it would sell in large numbers throughout the far-flung English-speaking dominions and add immeasurably to the popular, as well as the professional, knowledge of the world's resources.

The Swedish General Staff also deserve congratulations and commendation for the excellent craftsmanship in cartography which the map exhibits. Too much praise cannot be accorded the high quality of work represented by this map. It is noteworthy that the "Litografiska Anstalt" of the Swedish General Staff has produced some of the finest cartographic work of our time.

W. ELMER EKBLAW.

SEDGWICK, HENRY DWIGHT. *A Short History of Spain.* 400 pp.; illustrations, map, index. Little, Brown & Co., Boston, 1926. $3.50.

This book was not written for a textbook, nor is it in any sense a geographic treatise, but rather, as the author states, for the indolent and ignorant who wish to learn, with the least expenditure of

effort, the social and political history of Spain. Beginning with the native peoples, Iberians, Basques, and Celts, racial stocks and influences are discussed. Mr. Sedgwick also traces the domination of Romans, Visigoths, and Moors, and shows the rise of the Spanish Empire, then follows its decadence. For the historian this is a mere skeleton, but for the traveler or general student of Spanish life, this framework is skilfully hung with material on literature, painting, sculpture, architecture, and religion.

The author not only gives chronological facts along these many lines, but offers criticism and quotes freely other opinions in English, French, German, and Spanish. As he does not wish his readers to distrust his facts, he gives in Appendix A a long series of authorities. In so far as a geographer is interested in all the contributing factors which make a people what they are, this will prove a valuable book, but of economic geography there is scarcely a line. Spain materially a failure has nevertheless a contribution to make to the world in charm, gallantry, breeding, and chivalry. This contribution was expressed by Benevente, a Spanish writer, when asked what was most Spanish, as: "The modesty of our women not contaminated by feminism; the well-bred courtesy of our men; a frank and easy intercourse with equals or inferiors—for our people are the most democratic in the world. . . . True patriotism does not lie in boasting that we are sons of Spain, but in so living that wherever we are, and wherever we go, there shall be justice, loyalty, self-denial, honorable purpose, and a noble goal."

JULIA M. SHIPMAN.

UHLIG, C. *Die Bessarabische Frage.* 107 pp.; maps, tables, bibliography, and index. Ferdinand Hirt, Breslau, 1926. 3 Reichsmark. 8½ x 5¾ inches.

In this careful review of the question of Bessarabia's relations to Rumania and Russia, Dr. C. Uhlig, professor of geography at the University of Tubingen, has presented a nonpartisan study of a political problem about which most of the geographers of Europe are ready to confess themselves ignorant, and American geographers frankly even more uninformed. Such a thorough study as this throws much needed light upon the question and may help to solve the problem which contains within it potentialities for trouble as vast as any problem of the Balkans, and of which the solution may be as necessary to the peace of the world.

The treatment is essentially geographic from an orthodox point of view, beginning with a discussion of the extent and boundaries of the land, proceeding through a treatment of the physical and economic conditions and the origin and distribution of the population, to a prediction of Bessarabia's future. A chapter is devoted to a comparison of Russia's with Rumania's connections with the land, and one to the achievements of the Rumanian administration.

Within the limits of this little volume Dr. Uhlig has compressed the important geographic facts regarding Bessarabia in a most satisfactory way. Every student of European geography owes him a debt of gratitude.

W. ELMER EKBLAW.

CLINE, ISAAC M. *Tropical Cyclones.* xii and 301 pp.; maps, charts, tables, bibliography, and index. The MacMillan Company, 1926. $5.00. 6 x 9 inches.

For many years meteorologists, in the absence of adequate data, have held to certain theories concerning the distribution of winds and the other elements about a tropical cyclone; these theories were generally based upon physical principles more than upon actually observed facts. Now, Dr. Isaac M. Cline of the United States Weather Bureau comes out with his new book, *Tropical Cyclones*, and upsets many of these notions—and upsets them convincingly, too.

Probably no one has made a more careful and long-continued study of tropical cyclones than has Dr. Cline. He has for many years lived in a region which is rather frequently visited by these storms; and during this time he has been connected with the United States Weather Bureau so that he has had at his command all available data which might aid him in his study.

During the twenty-five-year period, 1900–1925, special observations were made every hour upon sixteen well-defined tropical disturbances as they passed through or near the various weather bureau stations. These observations comprised wind speed and direction, pressure, temperature, amount of precipitation during the hour, and the cloud movements. All of these data are incorporated in the text and form probably the most complete record of its kind yet available. More than half the book is given over to them under the caption, "Data in Cyclones."

In the first part of the book, Dr. Cline briefly outlines some previous studies in this field; these give the reader some idea of the theories now held. He also gives something of the occurrence of tropical cyclones, and the methods of recording and charting the data.

As important as this and the data themselves are, Dr. Cline's real contribution comes in the latter part of the book in which he gives his summary and conclusions in a most interesting and logical fashion. Here he shows definitely the distribution of the elements in a hurricane or tropical cyclone, and this is where the reader may be compelled to change some of his previous ideas. He further shows the influence of orography; states the conditions under which the cyclones cease to advance or redevelop; and discusses the general origin and development of tropical disturbances. Not the least desirable feature of

this work is the complete bibliography containing forty-seven references.

The author has very adequately carried out his object which he states in the introduction: "To show, more definitely than has previously been done, (a) the distribution of pressure as related to the cyclonic center, (b) the curvature of the isobars at various distances from the storm center, (c) the changes which take place in pressure distribution as the cyclone advances, (d) the wind directions and velocities as related to the cyclonic center, in the several parts of the cyclonic area, at short intervals of time and space, (e) the portions of the cyclonic area in which convergence of air currents occurs, and (f) the time and place of greatest precipitation intensity as related to the cyclonic center in tropical cyclones."

Dr. Cline has performed a real service in bringing out a book indispensable to the general and forecasting meteorologist—and the skeptic as well—and of great value to the general geographer. Geographers certainly cannot ignore the great havoc on both land and sea caused by these tropical cyclones. They need to have an intelligent appreciation of these storms as they are, and of the methods of forecasting them. Here is a book which adequately meets that need.

CLARENCE E. KOEPPE.

HOFFMAN, FREDERICK L. *Windstorm and Tornado Insurance.* 109 pp.; 17 halftone illustrations, maps, tables. The Spectator Company, 1926. $2.50. 5½ x 8½ inches.

Windstorm and Tornado Insurance is written from the standpoint of the insurance company; that is, with the idea to impress upon both insurance representatives and the people in general the need of insurance against property destruction by winds. The position no doubt is well taken; for, as stated in the preface, no large area in the United States east of the Rockies is exempt from windstorms. Indeed, the reader of this little book is quite convinced that insurance against losses by such storms is well worth the extra premium charged.

Dr. Hoffman explains the occurrence and causes of destructive wind storms, although in so doing he seems to cling to the old idea that winds blow spirally in toward the center of a cyclone. He enumerates and briefly describes the destructive effects of a number of windstorms throughout the United States, and outlines a variety of storm experiences of particular companies and by states.

The book undoubtedly meets a real need as the author suggests; for it graphically sets forth the relation of severe cyclones and tornadoes to the economy of the United States. It is to be regretted, however, that the publishers did not appreciate the value of making the book a little more attractive and readable in the matter of type selection.

CLARENCE E. KOEPPE.

HUMPHREYS, WILLIAM J. *Fogs and Clouds.* xiv and 104 pp.; 94 full page halftone illustrations, bibliography, and index. The Williams & Wilkins Company, Baltimore, 1926. $4.00. 5¼ x 8 inches.

Without question the finest collection of photographs of fogs and clouds yet assembled is found in Professor Humphreys' new book, *Fogs and Clouds.* There are eighty-four of these photos with an additional nine of lightning and other optical phenomena gathered from all parts of the world. When one first picks up the book, he is likely to become so fascinated with these decidedly realistic reproductions as to forget the some eighty pages of supplemental textual material.

Yet, if he has already read the same author's *Rain Making and Other Vagaries* or *Weather Proverbs and Paradoxes,* he will not be long in finding out what is written about fogs and clouds. In this new book, the author uses the same entertaining and attractive style as in these earlier books; yet, as usual, he does not sacrifice scientific accuracy.

In *Fogs and Clouds,* Professor Humphreys assumes that the reader is not a meteorologist; instead, that he is an intelligent lover of nature's handiwork. Accordingly, he outlines in a very simple and crisp style the processes of fog and cloud formation, discusses the various cloud forms, their heights, thicknesses, movements, and their relation to rain and weather; and he adds a final chapter on optics: lightning, rainbows, halos, coronas, etc.

To the person who objects to or has little time for a detailed study of clouds and related phenomena, this little book is a mine of interest and easy information. Both the author and publishers deserve the commendation not only of the geographer, but the general reader as well, in developing such an attractive and valuable little book.

CLARENCE E. KOEPPE.

BIZZELL, W. B. *The Green Rising.* x and 269 pp.; index. The MacMillan Company, New York, 1926. 7½ x 5½ inches. $2.00.

The following quotation from the author's introduction explains the title that he has chosen for his book: "The outstanding social movement of the post-war period has been the rise of agrarianism in almost every civilized country of the world. G. K. Chesterton, the well-known English writer, has called this the 'Green Rising.' 'The Green Rising is a peasant movement,' says he, 'where the Red is a proletarian movement.' The agrarian revolution started in Russia with the overthrow of the Romanoff dynasty, and since the close of the Great War it has swept over all the countries of Europe, and in some instances has influenced conditions in many parts of the United States. The so-called 'Green Rising' has been in progress in this country for several years, and today important economic and social changes are being brought about through its influence."

President Bizzell of the University of Oklahoma is fully qualified to write such a book as *The Green Rising*. No single problem of so much importance faces the nation today as the problem of "farm relief" and reëstablishing the prosperity of the farmer to a degree satisfactory to him. It is a problem to which the best minds of the country have given their thought and effort, apparently without avail. The futility of solutions proposed thus far probably arises from sectional differences of interest, opinion, and conception of the problem. Too little effort is being made by either the agriculturists or the industrialists to adjust their points of view, to make the national instead of the "bloc," or sectional, well-being the common interest. President Bizzell's book serves the two very useful purposes of pointing out the extreme significance of the problem, and presenting its historical background; by successfully doing these things he makes the problem much clearer.

The problem when it is solved will be solved by compromise, by the assumption by all groups of the common burden of maintaining the national welfare as the only sure and permanent method of maintaining the "bloc" or sectional welfare. No nation in the world except the United States combines within its own boundaries the coal and iron and other raw material resources to build up such a tremendous industrial organization and population, and the food and fibre resources to feed and clothe that population, and to support a great agricultural industry and population as well, both groups with a standard of living adequate to the best material, physical, and intellectual development and progress of its members. To assure this high standard of living to the people of the nation for hundreds and thousands of years to come, and to safeguard the integrity and perpetuity of the nation itself, all groups should join and work together instead of arousing or promoting any class or sectional jealousies and prejudices by ill-timed charges or recriminations.

The final two paragraphs of *The Green Rising* are significant: "The agricultural population has been slowly gaining economic and political strength in recent years. This is explained by the fact that the rural population has gained greatly in social consciousness and the agricultural wealth of the country has more than kept pace with industrial enterprise. This tendency supplies the basis of hope for the equilibrium of social forces.

"The Green Rising, therefore, whose swell tide may not yet have been reached, is not a sinister, social phenomenon. It is merely the subtle working of the silent forces of readjustment in the onward progress of national life. But there will be no peace until the diverging forces composing the complicated fabric of our social order can be brought nearer to equilibrium. If this be true, the Green Rising that is sweeping over the world gives the best possible promise of economic sufficiency and political freedom."

The Green Rising will certainly help to clear away misunderstandings. Both the western farm "bloc" and the eastern industrial group should read every page carefully. The book is lucidly written in non-technical style, the facts are logically presented in a non-partisan way, and the conclusions are drawn impartially and fairly. It is an opportune book. President Bizzell has rendered a patriotic service by writing this work; our people should read it—*now!*

W. ELMER EKBLAW.

GOWEN, HERBERT HENRY. *Asia: A Short History*. xx and 409 pp.; maps, illustrations, bibliography, index, chronological table of events. Little, Brown & Co., Boston, 1926.

A short history of the continent having the longest and most involved of all human histories must require, if it is to be of value, a writer of exceptional ability. *Asia: A Short History* is of rather decided value, not so much as a text, as a help to the understanding of some of the problems of Asia, and their relation to our own. In this book, Dr. Gowen recognizes the need of better understanding of international and inter-racial relationships, and has attempted to give us such an understanding; particularly as it regards contacts between the Orient and the Occident.

There is a general lack of appreciation of Asiatic culture and ideals, and of the significance of Asiatic History in Western civilization, particularly in America. Missionaries go to the Orient to introduce Christianity, knowing little of the remarkable and ancient religions of the countries to which they are sent, and in doing so, often hinder, more than help, the cause.

Rather than state the bare facts of Asiatic history for their own sake, Dr. Gowen prefers to treat it especially as it has influenced the history of civilizations and nations with which we are, perhaps, more familiar. "By reference to the East," he tells us, "we hope to make the history of the West more intelligible. . . . Civilization, as we know it, and as we trust it may in fuller measure become, is neither Oriental nor Occidental. Rather, it is the product of efforts both East and West, correcting and stimulating each other."

Anyone historically inclined, yet unfamiliar wich the history of Asia, has missed a vast and tremendous part of the story of humanity. The greatest of all continents, and the oldest, in point of human history, Asia has given birth to every great religion that the world has known. The tremendous waves of population surging back and forth across this great land mass, like the ebb and flow of tides, the magnificent personalities that it has produced, and the intricacy with which the course of events are interwoven, make her story as bewildering as it is intriguing.

Dr. Gowen gives us a glimpse of all this in his book. More than a glimpse could scarcely be expected in a work of this brevity, but it is such a glimpse as makes us eager for a longer look. He does not ignore geographic conditions as a basis of history.

The last quarter of the book deals with present social and economic conditions in the Orient, with the relations of Europe and America to Asia and the relations of the Asiatic countries to one another.

This book is fascinating. Its style is so fluent that reading is easy. It should be conducive to a better understanding of that great complex of peoples that is Asia.

CARLETON P. BARNES.

SÖDERLUND, ALFRED, editor. Population Map of Europe. Swedish General Staff, Lithography Plant, 1926.

Geographers should welcome this four-section, post-war population map of Europe which is drawn on Albers Conic Projection on a scale of 1: 4,000,000. The grill for the map is printed in blue, as are also the continental outline, the rivers and other water bodies and the international boundaries. Upon this most excellent base, a political coloring has been superimposed, the various countries being indicated in pleasing tones of brown, yellow, green, red, and purple. The delightful harmony of colors and their almost faultless registration go a long way toward making this map a work of art.

The population data are shown very graphically on the political structure in red by a combination of dots and spheres. Each dot represents 5,000 inhabitants; and in comparing dots with spheres, is to be regarded as a sphere of the same value. With this in mind, each sphere is drawn proportional to the number of inhabitants that it represents, and its relationship to the above basic value is indicated by a figure placed at its side. Thus under this plan the population of any city or town may be easily figured by a little mental calculation. Provision has been made for an overlapping of the two systems by stating in the legend that a cross "after a name indicates that a great number of inhabitants in the neighborhood is included in the sphere."

Another feature of the map is the scale of population density shown in the margin. By carrying over the values from this scale to the map, one can easily estimate the number of inhabitants to the square kilometer.

Only a few political names appear on the map. They are well chosen and include the names of countries, some of the larger districts and the principal cities. The capital city of each country is underlined. Wherever possible, these names are of course in Swedish, while the legend is in both Swedish and English.

Railway and steamship routes are shown on the map in a light gray solid line, while various devices of the same color are used to indicate the outlines of Sten de Geer's manufacturing districts, the southern forest limit and the northern arable limit. While these features may help explain the distribution of population to some extent and while they do not seriously clutter up the map, yet because of their subdued color they add so little, especially to a wall map, that it seems as if they might well have been omitted.

All in all, the map is, however, a credit to both its editors and publishers; it is the kind of undertaking which should be carried on for all the continents.

G. H. BURNHAM.

TOOTHAKER, CHARLES R. *Commercial Raw Materials*. 303 pp.; 44 pictures, 12 maps. Ginn and Company, Boston, 1927. $2.00.

The purpose of this book, as stated by the author, is to give the average business man an intimate knowledge of the things that enter into his own industry as well as a knowledge of the other products with which he comes in contact, and in this respect it completely fulfills its aim. To a geographer, it is a bit disappointing that the author does not carry his point further and explain why certain materials are found in some parts of the world, and why they move to markets in other parts of the world. However, the geographer will find much of value in this volume because of its completeness in considering practically all of the raw materials that enter into commerce, and its encyclopedic nature makes it a valuable handbook for the commodities of economic geography.

The raw materials are considered under the following heads: (1) foods, including cereals, legumes, starches, fruits, vegetables, nuts, meat, sugar, spices, etc., (2) beverages, (3) oils, fats, and waxes, (4) fibers, (5) skins, hides, and leathers, (6) woods, (7) gums, resins, and related products, (8) miscellaneous products, (9) metals and their compounds, and (10) nonmetallic minerals. The commodities under each main division are arranged in the order of their commercial importance.

The book is illustrated with many full page maps of the world showing, or attempting to show, the distribution of a number of the major articles of commerce, and also attempting to show graphically the relative importance of the chief producing areas. From a graphical point of view these maps are not successful in their purpose, and add little if anything to the value of the book. The chief faults of the maps are: (1) the size, making the producing areas so small that they do not give a clear picture of the locations of the regions, (2) the grid of the projection has such heavy lines that the graphic material appears subordinate to it, and (3) the lack of political boundaries of the countries, making it impossible for the reader to locate accurately the country that is represented by the bar across central

Europe, as is shown on the map of coal production on page 273.

In contrast to the maps the book contains more than forty well-chosen geographic pictures, many of them full page illustrations, which show methods of harvesting crops in various parts of the world, methods of handling these crops after harvest, and methods of changing the form of the raw materials into finished products. These pictures alone are worth the price of the book to the geographer. It is unfortunate, however, that the author did not acknowledge a single picture, as they would make a valuable collection in lantern slide form for the geography teacher if he only knew where to get them.

Another very fine feature of the volume is the outline used for various raw materials showing the by-products that are obtained from them. Such outlines appear on page 10, showing the uses of corn, on page 92, showing the uses of the coconut palm tree, on page 209, showing the by-products of the cattle industry, and on page 271, showing the by-products of coal.

The plant geographer will welcome the botanical and biological terms used throughout the book, as each commercial product has its Latin name given with it. In the back of the book there is also a list of the Latin names of plants and animals mentioned in the text with the page reference for each.

The one regrettable thing about the book is the absolute lack of a bibliography, the very thing that adds so much to a book as a reference for the busy teacher. The author, who has been the curator of the Philadelphia Commercial Museum for more than twenty-five years, has undoubtedly written much of the book from his own knowledge of the materials, but one wonders if other sources were not consulted during the compilation of the volume.

On the whole the book has many fine qualities and is certainly well worth the price. While it does not present any important new material that is not treated in texts on economic geography, it gives briefly the main facts about more commercial materials than could be found in any volume of like size. It is a book that every geographer should have on his reference shelf.

EDWIN J. FOSCUE.

JEFFERSON, MARK. *Peopling the Argentine Pampa.* viii and 211 pp.; photographs, maps, and diagrams; appendix and index. Research Series No. 16. American Geographical Society, New York, 1926. 8 x 5 inches. $4.00.

"The Pampa is Argentina; and Argentina is the Pampa." Not wholly true; but the importance of the vast, level, fertile plains is very nearly commensurate with that attributed to them in the enthusiastic phrase of an Argentine writer. Mark Jefferson, fully acquainted with the fact, has succeeded admirably in his presentation of an intensely interesting problem in geographic research. The volume is the fruit of a journey made in 1918, on behalf of the American Geographical Society, to study modern European colonization in Argentina, Brazil, and Chile, utilizing as a background an earlier acquired intimate acquaintance with Creole life.

Creole versus immigrant. Yet, the immigrant, the colonist, persistently and undeniably perseveres; and the native feels his foreign influence, but does not recognize it in its entirety. The *Porteños*, those of the coastal cities, as well as the *Arribeños*, of the uplands, are essentially Creole. The effect of the immigrant has been to make an interior Argentina Creole at the surface as well as at heart, and a Buenos Aires superciliously European at the surface, but undoubtedly Creole at heart.

In the setting, the author describes the historical and geographical influences contributing to the peopling of the Pampa. Although neither Mendoza grape-culture nor Tucumán sugar had direct bearing, their dominantly Creole characteristics gave rise to considerations fundamental in a treatment of the Pampa proper. From the setting, the discussion progresses to the conditions of immigration and politics, and then to the agricultural colonies.

The first of the colonies was Esperanza—Hope, originally Swiss, founded by Aaron Castellanos in 1856, in the east of the province of Santa Fé. Although the early years were difficult ones, the result was additional colonization. The immigrant had the alluring prospect of exceedingly fertile land of his own. San Geronimo, to the southwest, was second, again Swiss; third, San Carlos, largely Italian. Others were those along the San Javier, to the north of the city of Santa Fé and Esperanza, including the American colony California, founded possibly by ex-Confederates. In the south of the province, about Casilda, other colonies were established. The tremendous problem of the *arrendatarios*, the renters, here received its incipience. In the province of Entre Rios, colonization by Russo-Germans and Russo-Jews took place. The growth of these and many others, their difficulties, the development of land promoters, Indian menaces, other inimical influences, all receive careful analysis.

The chapter concerning the railroads and agriculture possesses an excellence which grips the reader. The carefully coördinated development of the spread of the railways and the transformation of agriculture, arising from the introduction of the iron road and agricultural colonization, makes it such.

In summarizing, Mr. Jefferson reviews the character and extent of the immigration, without which agricultural colonization was impossible. To complete the fine writing is a series of three eloquently graphic maps, representing the growth of cities and railroads in Argentina.

Mr. Jefferson displays a remarkably keen com-

prehension of the problems coincident with the development of the Pampa. To every geographer, *Peopling the Argentine Pampa* is recommended as a work of convincing merit.

CHARLES GOOZE.

CAMPBELL, MACY. *Rural Life at the Crossroads.* x and 482 pages, with diagrams and halftone illustrations. Ginn and Company, Boston, 1927. $1.96.

Out of the heart of the Corn Belt comes this volume, a rational plea for earnest consideration of the rural life problem in the United States. The author vividly portrays the significance of the farm in the development of the ideals which have permeated American institutions from colonial days to the present, and then, with striking clarity, he points out that a catapultic change has occurred during the last decades. In 1880 the population of the United States was 71.4 per cent rural and 28.6 per cent urban, whereas in 1924 the cities and towns held more than 70 per cent of the people while less than 30 per cent remained on the farms. This reversal of ratio seems destined to produce far-reaching results.

The greater reward to the worker offered by industry in contrast with farm life is held to be accountable for the great change. As a result there has been a steady drain of the most ambitious youth away from the farms. This drain is still on, and if continued will inevitably result in a farming class mentally and socially inferior to that of the past, and as a result will follow inefficiency and poverty whose tentacles will penetrate into all phases of American life. To check this tendency the author suggests education and coöperation.

A number of coöperative enterprises of varying degrees of success are analytically presented, their problems and special difficulties reviewed together with frank discussion of the degrees of success attained. To stimulate interest and apparently to give a touch of practicability to the work, several illustrations of the workings of coöperative marketing organizations are included, *e.g.* articles of incorporation and by-laws, and marketing contracts. These have been selected from several successful concerns now actively in operation.

The complexity of the rural problem is convincingly stated in chapters dealing with surplus production, land ownership and tenantry, property and income taxes, tariff, and judicial decisions. But back of all the discussion is the thesis that the rural problem of the United States is so complex and its solution so vital to the national welfare that it demands serious consideration on the part of all. Education is essential to furnish the enlightened citizenship necessary to support organizations able to accomplish efficient, orderly marketing of farm products, and such marketing is absolutely necessary if the farmer is to receive his rightful share of what he produces. Modern business is conducted on a large-scale, organized basis. If the farmers' efforts continue on a purely individualistic basis, their returns will inevitably be lower than their merits justify, and that will lead to social decadence and a peasant class on the farms. National welfare demands that such results be averted.

Thus out of the Corn Belt, the section which has keenly felt economic distress while industrial prosperity elsewhere has flung its banner high, has come an earnest plea for recognition of a problem of national significance. No political or legislative panacea is offered, but the importance of careful study of the geographic and economic bases of our social structure is pleaded.

NELS A. BENGTSON.

DIETRICH, BRUNO. *U. S. A., Das Heutige Gesicht.* 150 pp.; maps, charts, illustrations, bibliography, and index. Ferdinand Hirt, Breslau, 1926. 8 Reichsmark. 8½ x 5¾ inches.

"Oh wad some power the giftie gie us
To see oursel's as others see us."

In this very entertaining book, Dr. Bruno Dietrich holds up to us a German mirror in which we may see ourselves as the people of Germany view us. It is a friendly mirror, perhaps distorted somewhat to give us a really pleasanter picture than we deserve, but none the less significant. We might hesitate to accept it as a good likeness, but on the whole it emphasizes those features which make us internationally popular in some quarters of the globe, unpopular in others, all depending upon the point of view.

Dr. Dietrich knows us well from his travels through our land from coast to coast, from North to South, from city to county, from plain and prairie to plateau and pine forest. He enters our land by the New York gateway and makes New York the subject of his first study in the book. It is a stimulating and freshly novel picture of our colossal metropolis that he gives us, a picture of mass, and myriad numbers, and mere quantity unlimited!

The second study of "Das Rassenproblem und der Schmeltztiegel" is largely statistical and comparative, with a few reflections on the importance of the problem today and possibly tomorrow. The third study is of "Der Sterbende Indianer"; the fourth, "Stadt und Land"; and the fifth, "Wald und Wasser als Wirtschaftskrafte"; these indicate the breadth and divergency of subject that Dr. Dietrich has chosen for his studies. It is unnecessary to name more.

Suffice it is to say that the pristine point of view, the charming naïveté of treatment, and the discerning insight into our affairs, that characterize the book, recommend it, not so much as an authoritative reference as a refreshing and stimulating picture of our national self at the moment. It is fluently written, easily read, and well worth study.

W. ELMER EKBLAW.

OUR CONTEMPORARIES

THE GEOGRAPHICAL REVIEW

Vol. XVII, No. 1. January, 1927

The First Greenland Expedition of the University of Michigan. 35 pages. William Herbert Hobbs.
A stirring account of this ambitious expedition, with much of basic geographic value.

Chan-Chan: Capital of the Great Chimu. 26 pages. Otto Holstein.
Valuable descriptive geography.

The Camino del Diablo: With Notes on a Journey in 1925. 13 pages. Godfrey Sykes.
An illuminating narrative.

The New Palestine. 14 pages. Andrée Choveaux.
Good geography.

Southern Rhodesia: A White Man's Country in the Tropics. 18 pages. Ethel Tawse-Jollie.
Much of value on a land little known to Americans, a pioneer belt where an empire is extending its frontiers.

The Wineland Voyages: A Few Suggestions. 8 pages. Halldor Hermannson.
New light on an old subject.

The Physiographic Interpretation of the Nautical Chart. 13 pages. Raymond Stanton Patton.
Very good basic study.

The Boundaries of the Nijd: A Note on Special Conditions. 13 pages.
Geography well worth while.

The Problem of Coast Protection. 3 pages. Douglas W. Johnson.
Well presented.

Dr. Filippi's Explorations in the Himalaya, Karakoram, and Chinese Turkestan: A Review. 5 pages.

THE JOURNAL OF GEOGRAPHY

Vol. XXV, No. 9. December, 1926

Reading Purposes in Geography. 9 pages. P. W. Hutson.
Pedagogical.

Red Rock Canyon, California. 7 pages. William J. Miller.
Geological.

Some Principles of Commercial Geography. 6 pages. G. T. Renner.
Controversial; somewhat pedantic.

Our Study of Russia up to 1918 and of Soviet Russia. 7 pages. Madeline F. Goodale.
More project.

A College Cruise Around the World. 2 pages. Douglas C. Ridgley.
Brief notes.

The Prince's Birthday. 3 pages. Katheryne C. Thomas.
A raw point of view.

THE JOURNAL OF GEOGRAPHY

Vol. XXVI, No. 1. January, 1927

Cotton Manufacturing in the South. 11 pages. Howard Wilbur.
Good economic geography; an excellent bit of work.

The Early Historical Geography of San Francisco. 10 pages. Eric P. Jackson.
History, economics, commerce, agriculture, interwoven into a geographic pattern of good geographic texture.

The Geography of Imerina, Madagascar. 10 pages. Dan Bergsmark.
Well done, but brief.

Southward Ho! 4 pages. Jehiel S. Davis.
A prophecy.

Field Geography: A Usable Plan. 3 pages. Sam T. Bratton.
More method; good.

A Geography Pageant. 2 pages. Helen V. De Laplane.
And still more method; good, too.

THE JOURNAL OF GEOGRAPHY

Vol. XXVI, No. 2. February, 1927

Geographic Regions of the Philippine Islands. 9 pages. George S. Case.
A very good regional economic study.

Objectives of Elementary Education and How Geography Helps in Attaining Them. 5 pages. Anonymous.
Self-explanatory; method.

Gateways of the World. 8 pages. Mary J. Washington.
More method.

Background for the Study of Industrial Geography. 9 pages. Selma A. Hult and Nancy M. Waters.
And still more method.

A Trip Around the World. 3 pages. Clara Mallory.
And still more.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. L, No. 6. December, 1926

Skirting the Shores of Sunrise. 55 pages. Melville Chater.
A richly illustrated, and very interesting, description.

In the Birthplace of Christianity. 34 Autochromes Lumiere. Hans Hildebrand, Maynard Owen Williams, Gervais Courtellemont.
Little text, but a wealth of illustrations.

Among the Shepherds of Bethlehem. 24 pages. John D. Whiting.
Good description, richly illustrated.

Exploring the Earth's Stratosphere. 21 pages. Lieutenant John A. Macready.
A thrilling narrative.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. LI, No. 1. January, 1927

Jamaica, the Isle of Many Rivers. 43 pages. John Oliver La Gorce.
A bit of rather good geography, and illuminating description.

The Color Palette of the Caribbean. 11 natural color photographs. Jacob Gayer.

The First Autochromes from the Ocean Bottom. 8 natural color photographs. W. H. Longley, Charles Martin.
Startling exploration of a new kind.

Life on a Coral Reef. 22 pages. W. H. Longley.
Submarine natural history.

The Columbus of the Pacific. 31 pages. J. R. Hildebrand.
A résumé of Cook's Pacific cruises.

A Pictorial Jaunt Through Papua. 22 illustrations. Captain Frank Hurley.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. LI, No. 2. February, 1927

A Maryland Pilgrimage. 79 pages. Gilbert Grosvenor.
Many good pictures, and some good geography.

The Heart of Aymara Land. 28 pages. Stewart E. McMillin.
Wayside impressions.

High Lights in the Peruvian and Bolivian Andes. 18 natural color photographs. W. Robert Moore.

THE JOURNAL OF LAND AND PUBLIC UTILITY ECONOMICS

Vol. II, No. 4. October, 1926

Public Utility Depreciation Accounting. 16 pages. L. R. Nash.

Symposium on Iowa Land Appraisals:

Comparative Farm-Land Values in Iowa. 7 pages. Henry A. Wallace.

The Appraisal of Iowa Farm-Land Values by an Insurance Company. 4 pages. Griff Johnson.

The Principles Involved in Farm-Land Appraisal Procedure for Loan Purposes. 12 pages. Albert G. Black and John D. Black.

Reproduction Cost and Desirable Public Utility Regulation. 19 pages. John Bauer.

The Financing of Non-Governmental Irrigation Enterprises. 14 pages. R. P. Teele.

The Development of Public Land Policy in Australia. 7 pages. William H. Wynne.

Reform of the Agricultural Land System of Great Britain. 7 pages. J. P. Maxton.

THE JOURNAL OF LAND AND PUBLIC UTILITY ECONOMICS

Vol. III, No. 1. February, 1927

The Cost of Railway Capital under the Transportation Act of 1920. 20 pages. Herbert B. Dorau.

The Development of Public Land Policy in Australia. 11 pages. William H. Wynne.
Much of real geographic value.

A Study of Utility Financial Structures: Revenue Production Ratios. 16 pages. A. E. Patton and O. Gressens.

Absentee Farm Ownership in the United States. 13 pages. Howard A. Turner.

A Fair Return for Public Utilities. 10 pages. John H. Bickley.

Reasonable Rate of Return in Public Utility Cases. 6 pages. Howard D. Dozier.

Some Limitations of Arbitration of Public Utility Labor Disputes. 9 pages. E. W. Morehouse.

Is Public Utility Regulation Effective? A Review of Two Recent Books. 8 pages. Martin G. Glaeser.

THE BULLETIN OF THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA

Vol. XXV, No. 1. January, 1927

Jingis Khan, Chief of the Mongols. 19 pages. Joseph Sailer.
An interesting characterization of this famous Mongol leader and a brief account of part of his vigorous khanate.

The Opening of the Overland Route to India. 11 pages. Halford L. Hoskins.
A good article, chiefly historical.

The Sudbury Nickel Region. 10 pages. George H. Primmer.
Another good article, chiefly mining as related to economics and engineering; but little geography.

The Geography of the Codfishing Industry in Colonial New England. 8 pages. Stanley D. Dodge.
A valuable compilation of material on this one of the basic New England industries.

WORLD AGRICULTURE

Vol. VI, No. 2. Summer, 1926

World Forestry Number

The World Forestry Congress of 1926. 1 page. Samuel T. Dana.

The Need of Uniformity in International Forestry Statistics. 1 page. A. Serpieri.

Past, Present and Future of Forestry in Germany. 1 page. C. A. Schenck.
A brief summary, all too brief.

Fifty Years of Forestry in the United States. 1 page. W. B. Greeley.
Brief historical sketch.

Forest Development in the Philippine Islands. 1 page. George P. Ahern.
A few important facts.

Forest Practices as Affected by Land Ownership. 1 page. Ralph S. Hosmer.
Forestry plus a little economics.

Forest Work of the Tropical Plant Research Foundation. 1 page. D. M. Matthews.
A mere statement of plan and purpose.

Public Policies Toward Private Forests. 2 pages. William N. Sparhawk.
An enlightening discussion; valuable.

Town Forests and Farming. 1 page. Harris A. Reynolds.
A recent valuable phase of forestry, briefly summarized.

Some Important Forestry Books. 1 page. The Editor.

WORLD AGRICULTURE

Vol. VI, No. 3. October, 1926

The Eighth Institute Assembly. 2 pages.

ANNOUNCEMENT

THE series of articles on *South American Commerce*, by Dr. Clarence F. Jones, of which the fifth instalment, "Chilean Commerce," appears in this number, will continue in each successive issue until completed.

The series of articles, *Agricultural Regions of the World*, will be continued in the July issue with the third instalment of *Agricultural Regions of North America*, by Dr. O. E. Baker of the United States Bureau of Agricultural Economics. It is richly illustrated by many excellent maps in black and white, presenting the latest agricultural data available. This superb article will be completed in later issues, when another up-to-date colored map and the final textual material will conclude one of the best popular, thoroughly scientific presentations of North American agricultural geography in print. The next instalment in July will include important new data which have recently been tabulated and made available.

Agricultural Regions of South America, by Clarence F. Jones; *of Africa*, by Homer L. Shantz; of *Australia*, by Griffith Taylor; and *of Asia*, by Olof Jonasson, will follow in later issues.

All these articles will be illustrated by maps, charts, and pictures. The series will constitute one of the most complete geographic discussions of the world's agriculture thus far published.

To obtain the complete series of these extremely valuable articles, which present for the first time on such a comprehensive and accurate basis the significant divisions of the world's most important industry, it will be necessary to subscribe at once for ECONOMIC GEOGRAPHY, and date back to the October, 1926, issue.

In addition to this series of articles on agriculture, other series are being initiated; every issue will also contain four or five other articles dealing with urban and regional geography, with problems of land utilization, with programs of development of resources, with commerce, with transportation, with health, and with the hundred and one other subjects that are of present geographic interest, all by the most competent and best informed authorities in their respective fields. ECONOMIC GEOGRAPHY is indispensable to the intelligent citizen.

The subscription price to all charter subscribers in the United States and possessions is $4.00 the year or $7.50 for two years. To all foreign countries, $4.50 the year or $8.50 for two years. On January 1, 1927, the price was increased to $5.00 the year in the United States and possessions; to $5.50 the year in all foreign countries, but all who renew before the issue of the July number will be enrolled as charter subscribers at the original price. Address ECONOMIC GEOGRAPHY, Clark University, Worcester, Mass., U. S. A.